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ROCK PRODUCTS

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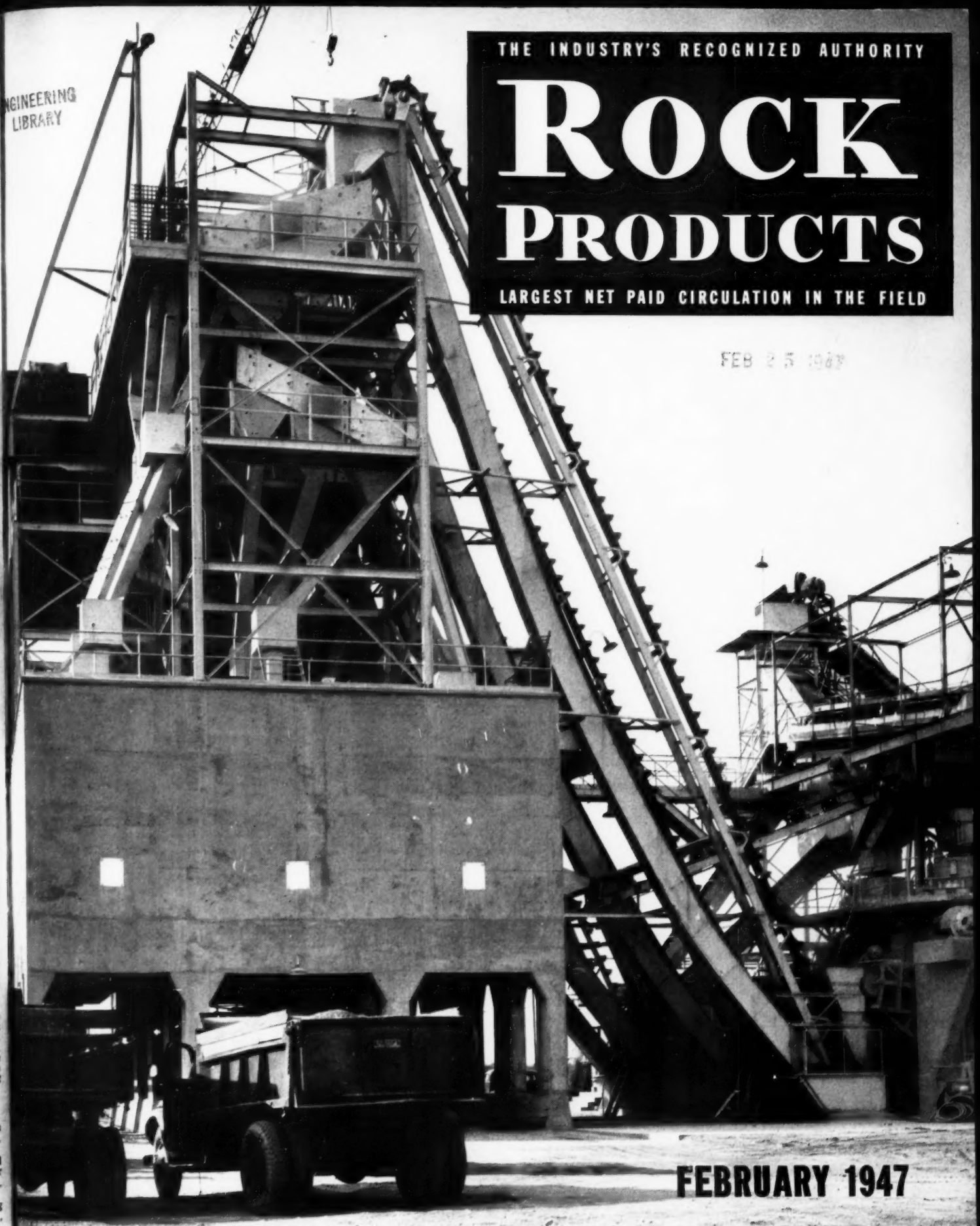
FEB 25 1947



FEBRUARY 1947

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WEST COAST PLANTS

Aggregates • Ready Mixed Concrete

Concrete Masonry Convention Program

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SPEEDY REDUCTION at LOW COST . . .

The above open view clearly shows some of the outstanding "Slugger" features. Notice the heavy-duty manganese steel hammers, 1" thick liners and breaker plates, the powerful drive shaft, the dust-tight waterproof housings on two heavy-duty, self-aligning roller bearings. These and other features are reasons why you can rely on the "Slugger" to reduce more tonnages at low operating costs.

ONE Williams "Slugger" does such a thorough job that it eliminates the need for other primary or secondary crushers. It will reduce stone weighing up to 75 and 100 pounds to 1¼", ¾", or agricultural limestone *in one operation.*

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WILLIAMS FINE GRINDING EQUIPMENT WITH AIR SEPARATION

Write today for our Bulletin No. 621 on how to get faster, more efficient fine grinding of limestone, lime, coal, talc, etc. There is a Williams Roller Mill with Air Separator to fit your requirements. Finenesses from 100 to 400 mesh. We also build Impact Mills with Air Separation; Mechanical Air Separators for classifying finely ground material or taking the fines out of dry material.

OLDEST AND LARGEST BUILDERS OF HAMMERMILLS IN THE WORLD

Williams

PATENT CRUSHERS GRINDERS SHREDDERS

It rides like a cloud— on B.F. Goodrich rubber springs

A typical example of B. F. Goodrich product development

CALIFORNIA bus riders are now enjoying a new kind of velvet-ride comfort on rubber springs in this two-section "articulated" bus, along with such luxuries as lavatories, extra spacious head and leg room, foam rubber seats, and scenery-level windows. The manager of the bus line says this big 40-passenger unit rides better than any other motor vehicle on the road. Here's how it happened:

Years ago, B. F. Goodrich engineers (who believe that *anything* can be improved) had found it possible to absorb shock and vibration in factories by mounting heavy machines on rubber. Why not try to do the same thing for cars and busses with a rubber spring? They did — and came up with the spring that will add more to your riding comfort than anything since the air-filled tire replaced the solid tire years ago.

The spring consists of a metal cylinder filled with rubber, with a shaft in the center — with the rubber firmly bonded to both cylinder and shaft. The weight of the bus connected to the shaft makes it turn inside the cylinder, gives a twisting action to the rubber. Bumps and road shocks are smothered by the twisting rubber *before* they reach the bus frame.

In addition to rubber springs, this new Kaiser Coach is equipped with a lot of other B. F. Goodrich products — tires, Koroseal upholstery and floor covering, Koroseal and metal bellows between sections, and many more; a few of the hundreds of B. F. Goodrich developments that have brought increased comfort, safety and efficiency to the American people and American industry. *The B. F. Goodrich Company, Industrial Products Division, Akron, Ohio.*

Koroseal — Trade Mark, Reg. U. S. Pat. Off.

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FIRST IN RUBBER

ROCK PRODUCTS

FEBRUARY, 1947 THE INDUSTRY'S RECOGNIZED AUTHORITY VOL. 50, No. 2

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Nathan C. Rockwood, *Editorial Consultant*

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"WE HEAR..."

February 1, 1947

Cement is in such short supply in Mexico that it is reported one Mexican construction firm had obtained a shipment from Poland. The cement has been offered at about $30 per metric ton, which is below the present black market price.

* * * * * * * * * * *

Production of brick and tile has risen very rapidly, according to the Bureau of Census. In October, 1946, production rose 12 per cent to a new high, totaling 627,250,000 brick equivalents. This rate is more than double that required for the veterans' housing program. For the first 10 months of 1946, production was 3,900,000,000 units, well in advance of housing requirements.

* * * * * * * * * * *

Shortages of crushed stone and bituminous materials for road building have plagued Indiana counties, according to reports. Allen county, for example, was not able to complete its 1946 road building program because it was unable to obtain sufficient crushed stone, and the commissioners were forced to re-advertise for bids because contractors could not fulfill quotas.

* * * * * * * * * * *

Federal Works Agency reported to Congress that in the 12 months ended last June, only 2964 miles of federal-aid highways were completed, less than in any war year and about 10,000 miles less than in 1941. Plans are complete for $3,200,000,000 of State and local public works.

* * * * * * * * * * *

The scope of collective bargaining with a union cannot be limited indefinitely by signing an agreement with the union for such a limitation. The National Labor Relations Board recently ruled that one union was not bound by an agreement of this kind signed about eight years ago. The company was advised it had failed to bargain in good faith as required by the Wagner Act.

* * * * * * * * * * *

In New York City, the construction industry has drawn up a wage agreement with labor in which overtime has been largely eliminated. Workers will get 25c to 40c more an hour, but they will work eight instead of seven hours, giving up double time for the eighth hour. The work-week will be held to 40 hours except in emergencies.

* * * * * * * * * * *

The latest report of the National Housing Expediter indicates that brick, portland cement, and concrete block will soon be in adequate supply or surplus to meet the housing program.

* * * * * * * * * * *

When B. C. Hartzler of Sharonville, Ohio, discovered that his concrete mixer had been stolen, his first reaction, was to ask the thief, "Where are you going to get the cement? If there's a place to get it I want to know about it."

* * * * * * * * * * *

A worker at a quarry recently lost his life in attempting to repair a valve on a hoist that stuck while a truck was being dumped. He was crushed about the head when the truck bed fell on him. More safety precautions apparently are needed in handling these emergency repairs.

(Continued on page 66)

(Continued from page 65)

Of interest to agricultural limestone producers is the announcement that Congress will continue its farm price support policy for at least three more years. Subsidies on farm products will continue at least until January 1, 1950.

* * * * * * * * * * *

An estimate of $10,000,000,000 for all construction in 1946 has been made by Engineering News Record which comes close to establishing a new record, particularly for peace-time construction.

* * * * * * * * * * *

Middle Atlantic States are planning a $7,000,000,000 public works program during the next five years, including federal and other state and city division expenditures. In this five-year period, New York will spend approximately $3,551,500,000; Pennsylvania, $1,898,250,000; New Jersey, $904,675,000; Maryland, $374,875,000; Delaware, $141,850,000; and the District of Columbia, $246,300,000. Most of the outlay will be for state highways, $2,300,000,000.

* * * * * * * * * * *

Industrial sand producers are faced with competition from another source. Believe it or not, it is reported that ground walnut shells are being substituted for sand in blasting certain metals, and are replacing foundry sand in making some types of castings.

* * * * * * * * * * *

It is possible to prevent a former employe, discharged for disobeying a company rule against soliciting union membership during working time for which he is paid, from immediately collecting unemployment compensation. A State supreme court has held in one case that such a discharge was willful misconduct so as to defer the discharged man's right to unemployment benefits.

* * * * * * * * * * *

For the country overall, the shortage of mechanics in the building industry and apprenticeship training, which was given such wide publicity in recent months, is being corrected rapidly. Some sources predict that the industry will soon be so over-manned that unemployment may result.

* * * * * * * * * * *

Travel over the $70,000,000 Pennsylvania Turnpike is fast returning to prewar levels, with an income for the first eight months of 1946, totaling $2,484,244, or about $450,000 more than for the corresponding 1941 period.

* * * * * * * * * * *

A noticeable trend toward raw material producers going into the finished chemicals field is marked by the announcement that the American Potash and Chemical Corporation will process potassium bromide instead of the raw material, bromine. Its new $4,500,000 plant at Trona, Calif., will produce soda ash and borax.

* * * * * * * * * * *

According to a report of the Committee on Maintenance Costs of the Highway Research Board, maintenance of highways now costs 35 per cent more than before the war.

* * * * * * * * * * *

Highway budgets in 11 western states are zooming to some very substantial figures. The California highway commission has budgeted $44,497,000 for the fiscal year 1947-48 to finance highway and bridge construction. The State's postwar highway building program will total $155,000,000. Oregon's highway commission has accepted a $6,000,000 deficit in its $31,655,000 budget for 1947, planning to make up the difference from $17,000,000 saved when the war called a halt to major construction. Colorado's three-year program calls for a $60,000,000 expenditure. Montana has a $46,000,000 postwar highway program with $10,000,000 of construction now under contract. Arizona has a $6,000,000 program.

THE EDITORS

★ ★ ★ Editor's Page

Social Insurance Under State Sponsorship

THERE is little likelihood that any new experiments in planned economy will come out of Washington for awhile or that any new regulatory bureaus will be created, at least for a couple of years, as the Republican Congress and the Democratic administration square off for 1948. They will be too busy conniving with and against each other to work out any new legislative plans and will thereby afford a welcome relief to the nation and industry for the first time since 1933.

Industry has been looking forward hopefully to such a time, when it could again plan ahead without worrying that new schemes thought up in Washington would come out of nowhere to ruin those plans.

There will be some relief, to be sure, from the pressure and threats of government legislation and regulation, but some of Washington's policies for more than the past decade, notably its persistent favoring and appeasement of labor, will affect industry from directions not yet anticipated or recognized. There is evidence now of a developing trend, through State action, of legislation to benefit labor that will bear watching by industry if it would plan ahead intelligently.

Sick Benefits

Labor's drive for more of everything in the field of social insurance on a broader scale than ever before, is being concentrated at present into a growing clamor for cash sickness compensation plans. It is significant, we think, that the States are now taking the initiative in the social security field. From eight to thirteen States likely will consider State disability compensation bills in their 1947 legislatures. Disability compensation, as already provided for in Rhode Island and California, and probably soon to be law in New Jersey, provides cash benefits for loss of wages from *non-occupation* illness as contrasted with benefits paid under workmen's compensation for illness contracted on the job.

While the plans already operative and others under consideration differ in some respects, they are all based on wage insurance, and the employer therefore, cannot escape being a party, even when he does not make the actual payments. The employer, at the very best, cannot get by with less than a great deal of unproductive bookkeeping, or bill-collecting, as the laws have been set up thus far, but the long-range political implications are much more serious and bear watching.

Rhode Island's compulsory cash sickness compensation act passed in 1942 is a State monopoly, providing for weekly benefits ranging from $6.75 to $18 weekly for as long as 20¼ weeks. Farmers, domestic servants and government workers are exceptions from the required payment of 1½ per cent of wages by the individual to the system.

California's law (1946) is so set up that insurance companies constitute a favored group that has been guaranteed, through legislation, a mass volume market. The law provides a system of optional State or private disability coverage to which a person can elect to subscribe. Private carriers have been able to offer superior plans to the State's. Here again, the employee shoulders the entire cost of the compensation, paying one per cent of his wages (State plan). The State fund pays from $10 to $20 a week for as much as 23.4 weeks while private plans, to be acceptable, must be equal or better.

Both these plans place the burden of payment on the employee, to be sure, but represent just the start for labor security benefits that could well develop along most any pattern, according to how successful politicians and favored groups might be in their aims for special benefits.

The non-occupational accident and sickness bill proposed for New Jersey provides for private operation under State supervision, the important difference (other than amount of benefits) being that the system would be paid for by the employer who in turn would be allowed to charge the employee one-half cent for each dollar of wages.

Extending Employer Responsibility

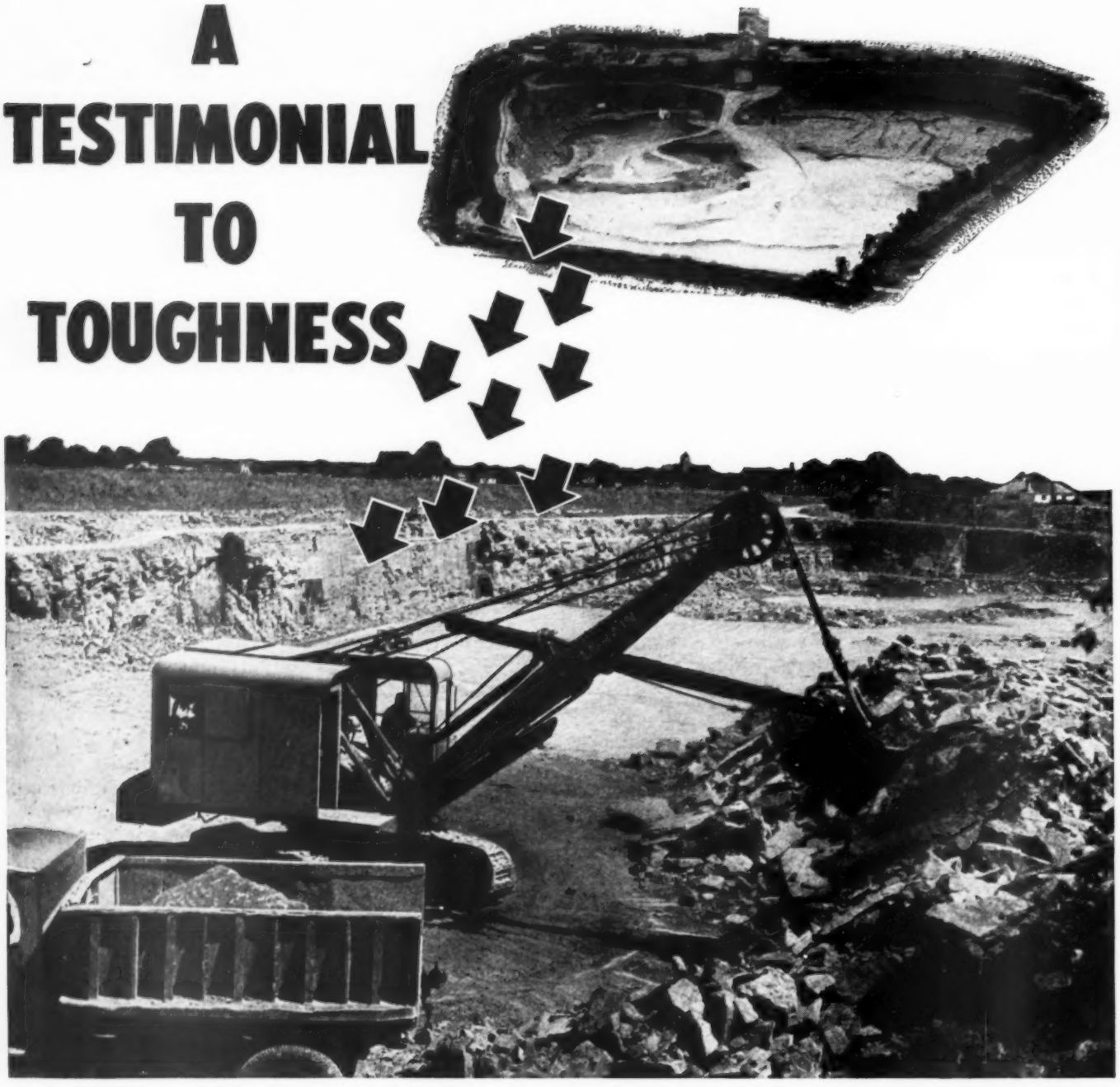
The effect of laws such as these has social significance, placing an increased responsibility — real or moral — on the employer for the individual's welfare off as well as on the job. Politically, they have unlimited implications. The proneness of politicians to make more and greater promises for the benefit of the groups they seek to influence could very easily extend the coverage, and provide for non-occupational hospital care and other benefits to the extent that employee payments alone would no longer suffice.

It is true that plans such as these help those that cannot afford illness by guaranteeing an income but the failings of human nature could well defeat their purpose. A great number of claims are being rejected by medical examining boards as unjustified.

So here we have another case of government—this time State—entering the domain of private enterprise, from which it is not easily dislodged.

Bror Nordberg

A TESTIMONIAL TO TOUGHNESS



● These close-up and bird's-eye views of a Lorain at work in the quarry of the Lutz Company, Oshkosh, Wis., serve to show both the type and magnitude of this rock handling job. Working against a 12 to 14 ft. face, this 1¾-yd. Lorain shovel loads from 800 to 900 yds. per 9 hour day.

It's a tough and steady job being the sole provider of rock for the crusher. But the Lutz Company has chosen Lorains 4 times to date and know from experience that the "business end" of their rock production is in dependable, efficient hands.

Lorain shovels have all the qualifications for rock service. Center Drive design of turntable permits concentration of full engine power on any one operation. A low, wide and heavy 2-speed chain drive crawler assures powerful traction and a stable base for close-in fighting. And the all-welded, steel shovel boom and dipper stick combined with chain crowd delivers the "Sunday punch" that makes for day in and day out production records.

Ask your local Thew-Lorain distributor for complete information on these heavy-duty Lorains. Their reputation as rock shovels is quarry-wide.

Reg. Trade Mark

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THE THEW SHOVEL COMPANY
LORAIN, OHIO

CRANES • SHOVELS • DRAGLINES • MOTO-CRANES

Rocky's NOTES

Nathan C. Rockwood

Alleged Purposes of N.L.R.A.

SINCE there is general agreement that revision of labor legislation is the most important domestic issue before the new Congress, it will not be amiss to review the preamble of the National Labor Relations Act, because that law must be weighed and amended by its success, or failure, to accomplish its alleged purposes. "Alleged purposes" is used advisedly because it is well known that the Act was written by employes of the executive branch of the federal government, whose enthusiasms and prejudices rather than judicial attitude make their work open to suspicion as to sincerity.

The N.L.R.A. was enacted July 5, 1935, in a whirlwind of other "industrial recovery" enactments, "to diminish the causes of labor disputes burdening or obstructing interstate and foreign commerce, to create a National Labor Relations Board, and for other purposes"—such is the title to the Act. There follow four paragraphs entitled "Findings and Policy," Section 1, which read (our own numbers, for later reference):

(1) "The denial by employers of the right of employes to organize and the refusal of employers to accept the procedure of collective bargaining lead to strikes and other forms of industrial strife or unrest, which have the intent or the necessary effect of burdening or obstructing commerce by (a) impairing the efficiency, safety or operation of the instrumentalities of commerce; (b) occurring in the current of commerce; (c) materially affecting, restraining, or controlling the flow of raw materials or manufactured or processed goods from or into the channels of commerce, or the prices of such materials or goods in commerce; or (d) causing diminution of employment and wages in such volume as substantially to impair or disrupt the markets for goods flowing from or into the channels of commerce."

Much "Double Talk"

Aside from the involved language, this paragraph is notable for its double talk, for it is not "the denial of employers" . . . etc. that is responsible for all the ills of industry enumerated, but *strikes* from whatever cause they originate. Every employer now knows that those strikes which have done the most damage to "flow of commerce," have not been caused by "denial by employers of the right to organize" or by refusal to accept collective bargaining. The worst ones have been caused by demands for closed shop, maintenance of union membership, for increased pay rates, or by jurisdictional fights between unions for the right (or better, the privilege) of organizing various groups.

The next paragraph of the preamble reads: (2) 'The inequality of bargaining power between employes who do not possess full freedom of association, or actual liberty of contract, and employers who are organized in corporate or other forms of ownership association substantially burdens and affects the flow of commerce, and tends to aggravate recurrent business depressions, by depressing wage rates and purchasing power of wage earners in industry and by preventing stabilization of competitive wage rates and working conditions within and between industries."

Employers' Unequal Bargaining Power

If the argument used in that paragraph is sound, it applies more accurately now to employers, who are not only deprived in the Act of any such inequality, but placed at the other end of the conference table. They are not and never have been permitted to organize industry on a national scale in order to combat labor unions organized to strike on an industry-wide basis. Hence labor may play one employer against another without any legal restraints. Moreover, this argument includes the now exploded economic theory that high wages with restricted production, high "purchasing power" and prosperity are synonymous.

The third paragraph of the law's preamble reads: (3) "Experience has proved that protection by law of the right of employes to organize and bargain collectively safeguards commerce from injury, impairment, or interruption, and promotes the flow of commerce by removing certain recognized sources of industrial strife and unrest, by encouraging practices fundamental to the friendly adjustment of industrial disputes arising out of differences as to wages, hours, or other working conditions, and by restoring equality of bargaining power between employers and employes."

Whatever the experience of industry prior to passage of the Wagner Act may have proved or disproved, experience under the Act has proved that the objectives of the paragraph (3) have not been and are not being promoted. How much is due to faulty or careless wording of the law itself, and how much to its prejudiced administration is of course debatable. There has been no real collective bargaining in many instances, because under rules developed by the National Labor Relations Board a small minority of a company's employes often won bargaining rights, while an unorganized majority refrained from voting at all, but was compelled by closed-shop or maintenance-of-membership provisions of new contracts to support union leaders who were known to be racketeers.

Consequently, instead of "removing certain recognized sources of industrial strife," etc., the act had the opposite effect of tremendously encouraging them—not infrequently disrupting associations of employes who had worked harmoniously with their employers for many years.

Expressed Policy Laudable

The fourth and last paragraph of the preamble of the law reads: (4) "It is hereby declared to be the policy of the United States to eliminate the causes of certain substantial obstructions to the free flow of commerce and to mitigate and eliminate these obstructions when they have occurred by encouraging the practice and procedure of collective bargaining and by protecting the exercise by workers of the full freedom of association, self-organization and designation of representatives of their own choosing, for the purpose of negotiating the terms and conditions of their employment or other mutual aid or protection."

That paragraph seems to cover the subject adequately. It could well be amended by dropping the last six words: "or other mutual aid or protection;" for employes certainly have no right or reason to bargain with *their employers* about anything except "terms and conditions of employment." Mixing up these other things, or attempting to, has been a major cause of strife and dissention.

We suggest that Congress begin amendment of the Act by striking out the first three paragraphs of the preamble, quoted above, and then revise the Act to honestly conform to the announced "policy of the United States."

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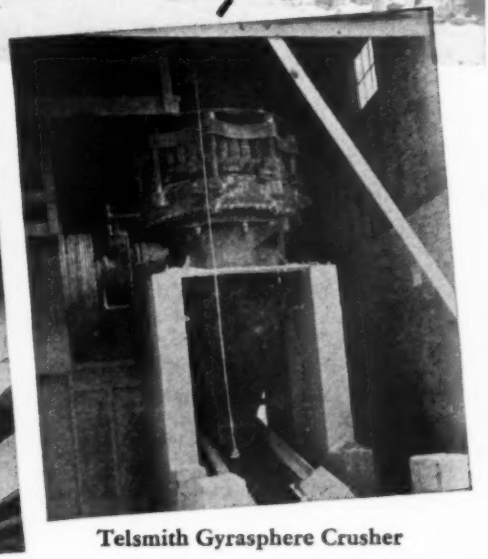
Telsmith Jaw Breaker



Telsmith Gyrasphere Crusher

● The Telsmith-equipped plant of Courtney & Plummer, contractors and producers, at Neenah, Wis., turns out 100 cu. yds. an hour. Three sizes of crushed stone are made—fines, passing 5/16" sq. screen opening, used for aglime; minus ¾" chips used for resurfacing material; and minus 1¼" used for highway and building construction after preparation in the Courtney & Plummer ready-mixed concrete plant. Sound plant design plus the exceptional efficiency of Telsmith equipment, enables the plant to operate with only two men. Telsmith equipment includes: 36" x 10' Heavy Duty Apron Feeder; 25" x 36" Roller Bearing Jaw Breaker; 4' x 12' triple deck 2-bearing Vibro-King finishing screen; 36" Gyrasphere Secondary Crusher. Modernizing the old, or building a new plant? Consult Telsmith engineers... get Bulletin Q-11.

MILWAUKEE TELSMITH WIS. U.S.A.

Q-18

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Association NEWS

SEVERAL important developments have occurred in the national picture which are expected to have a profound influence on business, particularly as they affect rock products producers. These problems are of such urgent character that special meetings have been called by the national associations to weigh their effects and determine what action may be necessary to meet them.

Portal-to-portal pay suits are of such threatening import to our economy that the government in the famous Mt. Clemens Pottery case is in the anomalmous position of attempting to extricate itself from an embarrasing position by having the court modify its decision on portal-to-portal pay without bringing down the wrath of the CIO. If anything approaching the amounts to be assessed industry are allowed by the court, the federal government will have eliminated a good share of its income from taxation and industry itself will be prostrate. Congress is aware of the dangers involved to our economy and it is expected that legislation will be rushed through to counteract the effect of any court decision.

Another problem of much concern is the substantial increase in freight rates recently granted the railroads. When these rates are made effective by the railroads, it is anticipated that a considerable volume of freight will change from rail to truck haul, but in some cases this may not be economically possible and a diversion to new sources of supply will be required.

Sand and Gravel - Ready Mix Conventions

A tentative program for the conventions of the National Sand and Gravel Association and the National Ready Mixed Concrete Association has been released by Executive Secretary Vincent P. Ahearn. The meetings, as previously announced, are to be held at the Hotel Biltmore, Los Angeles, Calif.

There will be a meeting of the Executive Committee of the National Sand and Gravel Association at 2:30 p.m. Sunday, March 2. On Monday, there will be meetings of the Boards of Directors of both associations.

Tuesday, March 4

At the first convention meeting, President Richard N. Coolidge will give his address and will be followed by reports by Executive Secretary V. P. Ahearn and Director of Engineering Stanton Walker. "Car Supply in 1947" is the subject of an address by W. C. Griffin, district manager, Operations and Maintenance Department, Car Service Division, Association of American Railroads, which will complete the morning's program. Election of officers will follow this paper. In the afternoon there will be an inspection of sand and gravel plants in the Los Angeles area.

Wednesday, March 5

The National Ready Mixed Concrete Association will hold its first meeting in the morning with President Chas. W. Shirey presenting his address which will be followed by reports of Executive Secretary V. P. Ahearn and Director of Engineering Stanton Walker. The reports on the Safety Contest and the Committee on Truck Chassis will be presented by Harry F. Thomson, V. P. Ahearn and Stanton Walker, respectively.

At noon there will be a joint luncheon with Robert Mitchell, presiding. Greetings will be extended by Chas. H. Purcell, Director of Public Works, State of California, and the address will be by Wm. M. Jeffers, vice-chairman of the Board of Directors, Union Pacific Railroad.

The joint program of both associations in the afternoon will be presided over by Paul C. Graham. The following papers will be presented: "Legislation by Congress Affecting Labor-Management Relations," by Chas. A. Horsky, counsel for both associations; "Group Action by Producers in Development of Area Labor Agreements" by Richard W. Lund, counsel, Southern California Rock Products Association; "Current Tax Problems in the Sand and Gravel and Ready Mixed Concrete Industries," by Robert Ash, tax counsel for the two associations. There will be a reception by the Manufacturers Divisions in the evening.

Thursday, March 6

The morning session will be a joint meeting with Carl R. Olson, as presiding officer. Addresses at this meeting will be as follows: "Durability of Concrete as Affected by Aggregates" by Thomas E. Stanton, Materials and Research Engineer, California State Highway Department; "Lightweight Aggregates for Concrete" by Raymond E. Davis, Professor of Civil Engineering, University of California; "A Housing Report for 1947" by Fritz B. Burns, president, Kaiser Community Homes; and "Construction Activity in the Year Ahead" by Thomas S. Holden, president, F. W. Dodge Corporation.

In the afternoon, the National Sand and Gravel Association will hold a meeting with Thomas E. Popplewell, presiding. The following papers will be presented: "Use of Industry Products for Granular Bases in Highway Construction," by Harry D. Jumper, engineer, Consolidated Rock Products Co.; "Practices of Western States Using Sand and Gravel in Bituminous Mixtures," by Ezra C. Knowlton, vice-president, Utah Sand and Gravel Co.; "Municipal Zoning as it Affects Sand and Gravel Operations in Los Angeles County" by Clyde P. Harrell, Jr., member of the Los Angeles Bar. Following this meeting, the ROCK PRODUCTS safety trophies will be presented.

Friday, March 7

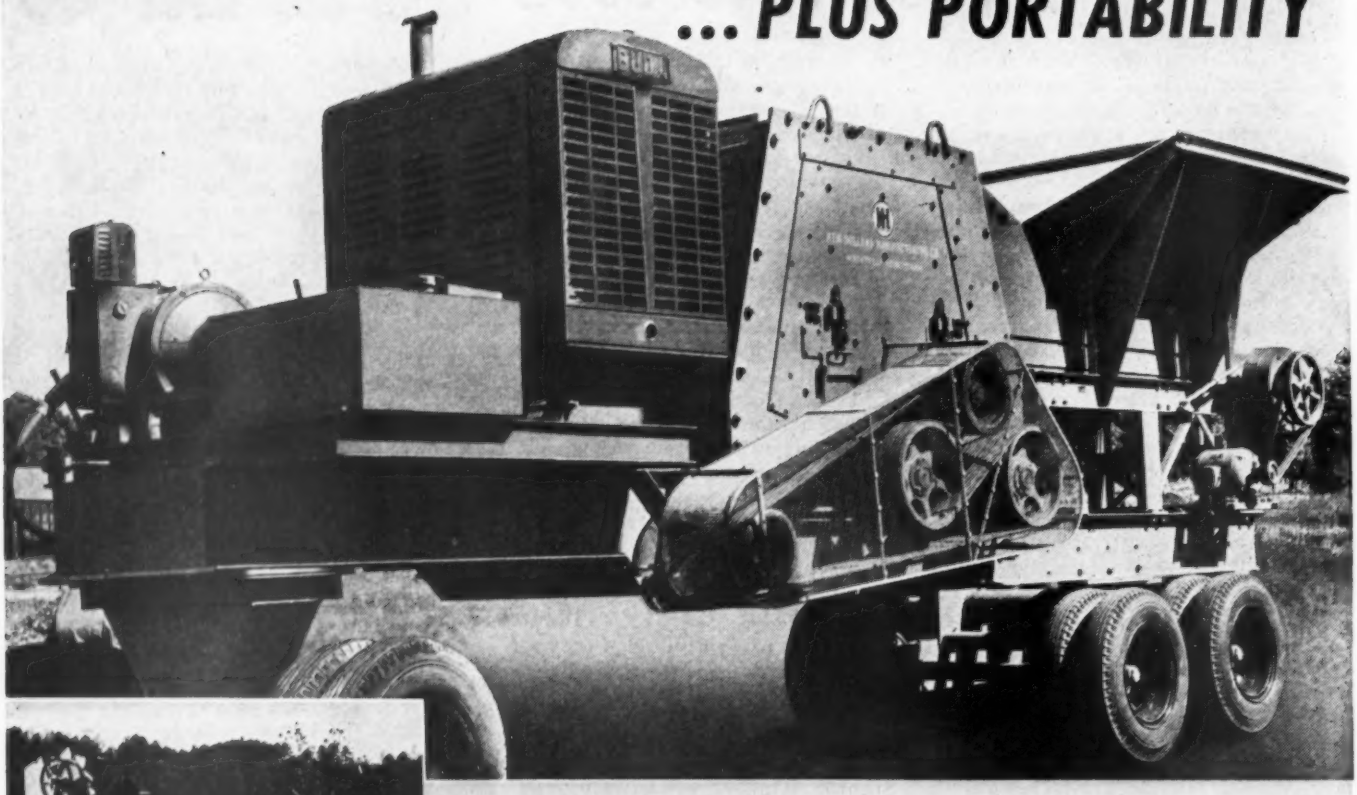
At the final session of the National Ready Mixed Concrete Association on Friday morning Frank P. Spratlen, Jr., will preside: "Control of Quantity of Entrained Air in Concrete" will be discussed by Stanton Walker, Director of Engineering. This will be followed by an Open Forum on Merchandising of Ready Mixed Concrete. This will be divided into two parts with Robert C. Collins, chairman of the Committee on Merchandising, leading the first section, and the second section led by W. D. M. Allan, director of promotion, Portland Cement Association, outlining the development of ready mixed concrete markets through Advertising and Promotional Campaigns.

In the afternoon there will be an inspection trip of ready mixed concrete plants in the Los Angeles area.

The local Committee on Convention Arrangements includes: Robert Mitchell, chairman; H. G. Feraud, executive secretary; and P. J. Akmadzich, S. H. Bacon, Harry E. Bender, L. H. Chandler, George L. Eastman, H. N. Goodreau, Paul C. Graham, John D. Gregg, M. F. Joyce, E. A. Lockett, Dewey Manning, Edward R. Sidebottom, L. Glenn Switzer, and W. J. Van Valkenburgh.

PROVEN BREAKER PERFORMANCE

... PLUS PORTABILITY



The Model 3030 Breaker now goes wherever you need it. A complete portable unit, with power for on-the-spot production of cubical aggregate . . . anything from road ballast to ag lime. Right from the source nearest the job. Eliminates long, quarry-to-job hauling costs. It's the same high capacity Breaker . . . turning out extra profits from portability.

Here, wheels removed, the portable Model 3030 Breaker produces cubical aggregate for the Virginia Department of Highways, at Alta Vista, Va. Dual Impact action has a rated capacity of 75 to 150 tons per hour . . . on 75 to 150 h.p. Easy adjustments of impeller r.p.m. and breaker bar spacing produces any desired size from ag lime to road ballast. Write Dept. T-1 today for full details.

NEW HOLLAND MANUFACTURING CO.
MOUNTVILLE, PA.

NEW HOLLAND
DOUBLE IMPELLER BREAKERS

PRIMARY AND SECONDARY CRUSHING IN ONE FAST ACTION

the *Personal Side* of the news

Named President

E. W. McGovern, sales manager and director of the Hermitage Portland Cement Co., Nashville, Tenn., which was recently purchased by the Marquette Cement Mfg. Co., Chicago, Ill., has been appointed president of the company. Cecil Sims, attorney, has been named vice-president and R. C. Jones will continue as secretary-treasurer. Frank Pearson, vice-president of the Cumberland Portland Cement Co., Cowan, Tenn., which was also purchased by Marquette, has been appointed president of the company. P. T. Crownover, veteran of over 25 years in the cement industry, has been named vice-president and sales manager. C. J. Hines will continue as secretary-treasurer. Both the Hermitage and Cumberland companies will remain intact, differing only in new incorporation, and will continue to operate under their original policies, brand names and with essentially the same personnel.

General Manager

Arthur F. Peterson, manager of the Cornwall ore division of the Bethlehem Steel Co., Bethlehem, Penn., has been appointed general manager of raw materials properties, with headquarters in Bethlehem. Sheldon J. Shale, superintendent of the ore concentrator plant in Lebanon, will succeed Mr. Peterson as manager of the ore division. Mr. Peterson joined the company in 1924 as superintendent of Cornwall mines. He is a graduate in mining engineering from the University of Wisconsin, and is a member of the American Institute of Mining and Metallurgical Engineers. Mr. Shale was graduated from Syracuse University in 1936, at which time he became associated with the company as a "looper." Later he was assigned to the mechanical department at the concentrator plant and subsequently was made assistant superintendent and two years ago was made superintendent.

A.C.P.A. Nominees

Elmer L. Johnson, Concrete Conduit Co., Colton, Calif., has been nominated for the presidency of the American Concrete Pipe Association, Chicago, Ill. Other candidates chosen by the Nominating Committee are H. Eschenbrenner, Universal Concrete Pipe Co., Columbus, Ohio, as 1st vice-president; Henry C. Eames, New England Concrete Pipe Corp., Newton Upper Falls, Mass., as 2nd vice-president; and F. B. Gray, Gray Concrete Pipe Co., Thomasville, N. C., as 3rd vice-president. George B. Denham, Faulkner Concrete Pipe Co., Hattiesburg, Miss., has been nominated for secretary; C. H. Bullen, Mid-West Concrete Pipe Co., Chicago, Ill., for treasurer; and for directors, Hugh P. Ford, Eugene Concrete Pipe and Products Co., Eugene, Ore.; T. J. Walsh, Nelson Concrete Culvert Co., East St. Louis, Ill.; and E. H. Fox, Concrete Pipe Co., Cincinnati, Ohio.

Chief Chemist

L. R. Forbrich, formerly chemical research engineer of the Bessemer Limestone and Cement Co., Youngstown, Ohio, has been appointed chief chemist of the Green Bag Cement Co. of Pennsylvania, Pittsburgh, Penn.

Sales Executives

Wendell R. Doolittle, Jr., has been named assistant sales manager of the Chicago territory of the Universal Atlas Cement Co., New York, N. Y. Helge E. Jacobson has been appointed district sales manager and Welby A. Hoblit, special representative, of the Illinois-Wisconsin district. Mr. Doolittle started with the company at the Buffington, Ind., plant in 1929. He subsequently became sales representative in Wisconsin and later in Chicago, Ill. Mr. Hoblit joined the company in 1916, serving as sales correspondent, sales representative and district sales manager. Mr. Jacobson joined the company as a clerk in 1918 and since 1924 has been sales representative in Illinois.

Chief Engineer

Henry P. Reid, assistant to the president, has been appointed chief engineer of the Universal Atlas Cement Co., New York, N. Y. Mr. Reid has been associated with the company for 23 years, having served successively as special engineer, operating engineer and, since 1942, as assistant to president. He is the author of "Studies of Fuel Economies in Burning Portland Cement," "Use of Fuel in the Manufacture of Portland Cement," and "Use Classification of Coal in the Portland Cement Industry." Mr. Reid is chairman of the General Technical Committee of the Portland Cement Association and former chairman of the Manufacturing Research Committee of the same association.

Henry P. Reid

Elected President

N. A. Holmer, vice-president in charge of sales for The Carney Co., Inc., Mankato, Minn., has been elected president of the Industrial Mineral Wool Institute of New York. Other officers are L. H. Harriman, National Gypsum Co., Buffalo, vice-president; M. G. Jensen, Owens-Corning Fibre Glass Corp., New York, treasurer; and T. C. Carter, Eagle Pitcher Sales Co., Cincinnati, and W. H. Hill, Baldwin Hill Co., Trenton, N. J., members of the board.

Goes to Peru

S. G. McAnally has been engaged by the Peruvian Government to investigate limestone and other cement raw material deposits of Peru with the expectation of building two or more new cement plants. He recently constructed and operated a cement plant for Cimento Brasiliero, Brazil, S. A. Mr. McAnally was formerly superintendent of the Pennsylvania-Dixie Cement Corp. plant at Clinchfield, Ga.

Assists President

William H. Klein has been appointed assistant to the president of the Lawrence Portland Cement Co., New York, N. Y., but will continue his independent consulting practice. He was formerly vice-president and a member of the board of directors of the Pennsylvania-Dixie Cement Corp.

A.S.C.E. President

Edgar M. Hastings, Richmond, Va., chief engineer of the Richmond, Fredericksburg and Potomac R. R. Co., has been elected president of the American Society of Civil Engineers for 1947.

N.S.A. Officers

At the recent convention of the National Slag Association in Washington, D. C., the board of directors elected W. E. Bliss as president; E. L. Flad, vice-president; E. W. Bauman, secretary; W. S. Shaw, treasurer, and H. J. Love, managing director.

Named President

H. D. Baylor, vice-president of the Louisville Cement Co., Louisville, Ky., has been named president of the company.

Association Officers

PENNSYLVANIA STONE PRODUCERS ASSOCIATION elected the following officers and directors for the ensuing year at the annual meeting in Harrisburg, Penn., on January 8, 1947: President, John Curtin, Sr.; vice-president, T. C. McPoyle; treasurer, Ellwood Gilbert; secretary, Walter H. Fehr. Board members elected for the western section were Paul I. Detwiler, New Enterprise Stone and Lime Co., New Enterprise, Penn., and Charles Coburn, The Carbon Limestone Co., Youngstown, Ohio; for the central section, W. E. Wilson, Hoffman Bros. & Wilson, Harrisburg, and S. D. Narehood, Narehood Bros., Milton, Penn.; for the eastern section, J. P. Peacock, Bethlehem Steel Co., Bethlehem, Penn., and H. M. Binkley, Binkley Bros. & Ober, East Petersburg, Penn. H. H. Wagner was reappointed as general manager of the Association.

Association President

W. S. STONE of Princeton, Ky., has been elected president of the Kentucky Crushed Stone Association, succeeding Verne C. Morgan, secretary-treasurer of the Kentucky Stone Co., Louisville, Ky. Other officers elected are Bruce Isaacs, Lexington, vice-president; J. R. Thompson, Frankfort, treasurer; and Mrs. S. D. Pace, Burkesville, secretary.

N.A.L.A. Elections

ROBERT M. KOCH has been reelected secretary of the National Agricultural Limestone Association, Inc., Washington, D. C. CLARENCE A. MUNZ, vice-president of Eastern Rock Products Corp., Utica, N. Y., has been reelected president of the Association. H. C. GRAY, secretary-treasurer of the Standard Paving Co., Tulsa, Okla., has been elected executive vice-president, and DONALD U. SMITH, president of D. U. Smith & Bro. Co., Ashley Falls, Mass., was reelected treasurer.

Donald U. Smith

Clarence A. Munz

Mr. Koch, a graduate of Massachusetts State College, where he majored in agriculture, served five years with the Agricultural Adjustment Agency in Franklin County, Mass. In 1941 he went with the Northeast Regional Office, Washington, D. C., of the A.A.A., which is now the Field Service Branch of the Production and Marketing Administration, U. S. Department of Agriculture, where he was in charge of the Conservation Materials Unit until his resignation in December, 1946, to become secretary of the National Agricultural Limestone Association.

H. C. Gray

Joins A.R.B.A. Staff

MISS CATHERINE CREWS has joined the American Road Builders' Association in Washington as a staff writer in the Public Relations Division and will work under the direction of Roscoe Ellard, president of the division.

Named Vice-President

COL. HARRY A. MONTGOMERY has been appointed vice-president and chief engineer of the Material Service Corp., Chicago, Ill. Col. Montgomery, awaiting retirement after 28 years with the Corps of Engineers, recently returned from Manila where he was chief engineer of American troops in the Western Pacific. He received the Distinguished Service Medal for his work as production head of equipment and supplies for the Corps of Engineers in the Great Lakes division.

Argentine Visitor

PEDRO P. BARDIN, Tggam S. A. Industrial, Alsina 1115, Buenos Aires, Argentina, was a recent visitor to the offices of ROCK PRODUCTS. The company produces white cement, gypsum, lime, ceramics, non-metallic minerals and building materials.

Sales Manager

ARTHUR L. CURTIS has been appointed district sales manager for the Lone Star Cement Corp., Indiana Division, with headquarters in Chicago, Ill. He succeeds J. E. Simpson, who has resigned.

Appointed Manager

KENNETH BAIRD, of Mt. Vernon, Wash., has left for San Bernardino, Calif., where he has accepted a position as manager of the Colton Cement Products Co.

P.C.A. Engineer

ALLEN B. BENZICK has been appointed office engineer for the Portland Cement Association, Minneapolis, Minn.

Robert M. Koch

Addresses Club

DR. A. ALLEN BATES, vice-president of research and development, Portland Cement Association, Chicago, Ill., recently addressed the City Club of Cleveland, Ohio, on the production of atomic bombs by United States and Russia. In his address, the title of which was "An Engineer Looks at the Future," Dr. Bates said that "Russia will be unable to match present United States production of atomic bombs until the better part of another generation has passed, say 15, 20 or 25 years. By that time there will be no alternative but to give the bomb to an international body for control."

On N.I.C.B. Board

JOSEPH S. YOUNG, president of the Lehigh Portland Cement Co., Allentown, Penn., has been elected a board member of the National Industrial Conference Board. He was recently appointed chairman of the board of the Portland Cement Association, Chicago, Ill.

OBITUARIES

WILLIAM LOVELL BALDRIDGE, president of the E. R. Baldridge and Co., Inc., Hollidaysburg, Penn., died January 3 after a long illness. He was 77 years old. Mr. Baldridge, with his father, was one of the early stone pioneers in Blair, Bedford and Huntingdon counties, where the company's stone quarries are located. His father, E. R. Baldridge, opened the first quarry in 1903 in the mining of ganister rock.

BEN F. TAYLOR, assistant advertising manager of the American Air Filter Co., Inc., Louisville, Ky., passed away December 21.

CARL E. WALLANDER of Cleveland, Ohio, representative of the Kensington Steel Co., Chicago, Ill., died on January 7 after a brief illness.

J. LEA FEARING, JR., manager of the Allentown, Penn., office of the St. Regis Sales Corp., subsidiary of the St. Regis Paper Co., died in White Plains, N. Y., on December 17, after a short illness. He was 45 years old.

HERBERT F. RAWLL, a director of the Pacific Portland Cement Co., San Francisco, Calif., died on January 13 in Greenwich, Conn., where he resided, at the age of 65.

JOHN J. KELLY, manager of industrial relations for Marquette Cement Mfg. Co., Chicago, Ill., died suddenly December 7 while on a business trip to the Oglesby, Ill., plant. He was 53 years old. Mr. Kelly joined the company at Oglesby in 1927, where he served as office manager and then employment manager. In 1937 he was appointed manager of industrial relations and two years ago moved his headquarters to Chicago.

PAUL SHERMAN, owner and manager of the Sherman Stone and Gravel Co., Topeka, Kans., died November 22 at the age of 61.

DR. PAUL F. CADMAN, director of research and assistant to the president of Henry J. Kaiser Co., Oakland, Calif., died recently after a short illness. Dr. Cadman is a brother of the late Charles Cadman, president of the U. S. Lime Products Co., San Francisco, Calif. Before joining the Henry Kaiser organization, Dr. Cadman was chief economist of the American Bankers Association. He also previously had been president of the American Research Foundation, executive secretary of the San Francisco Stock Exchange, and professor of economics and dean of men at the University of California.

CLAUDE F. MULLEN, founder and president of the Florida Sand and Gravel Co., Chattahoochee, Fla., died December 15 while on a business trip to Florida. He was planning to return to Cleveland, Ohio, where he resided, for the Christmas holidays. Mr. Mullen was also president of the Masters & Mullen Construction Co., Cleveland, Ohio, and a director of the National Sand and Gravel Association. He was 72 years old.

E. H. JEFFORDS, recent director of Raybestos-Manhattan, Inc., Passaic, N. J., and general manager of General Asbestos and Rubber Division, North Charleston, S. C., died December 12 at his home in Charleston, S. C., at the age of 71.

JESS C. DEVILBISS, vice-president in charge of sales for the United States Potash Co., New York, N. Y., died November 29 at the age of 59. Mr. DeVilbiss had been with the company since 1932.

W. F. NUGENT, former president of the Nugent Sand Co., Louisville, Ky., died December 23. He was 76 years old.

JOHN L. DARTT, traffic manager for the California Portland Cement Co., Los Angeles, Calif., died November 14 after a long illness. He was 65 years old. Mr. Dartt had been with the company since 1918.

Universal Safety Record

PERFECT SAFETY RECORDS in 1946 were made by four plants of the Universal Atlas Cement Co., New York, N. Y. These plants are at Northampton, Penn.; Leeds, Ala.; Hannibal, Mo.; and Duluth, Minnesota. M. W. Winsch is plant manager and W. E. Gehres is safety inspector at Northampton. W. O. Lawrence is plant manager and E. Y. Rew is safety director at Leeds. R. D. Mayne is plant manager and C. F. Colley is plant engineer in charge of safety at Hannibal. Fred Robinson is plant manager and E. G. Staley is supervisor of safety and labor at Duluth. These plants all have been repeat winners of the Portland Cement Association safety awards, the Duluth plant achieving a record of 11 calendar years without a lost-time accident.

Ohio Lime Conference

OHIO STATE UNIVERSITY, Agronomy Department, held its annual Ohio Lime Conference at the Deshler-Wallick Hotel, Columbus, Ohio, on January 3. Producers and agricultural leaders attended the conference. Earl Jones, extension agronomist, was active in preparing the program.

Cement Production

BUREAU OF MINES reports that production of finished cement during November, 1946, totaled 15,335,000 bbl. or 43 per cent above that reported in November, 1945. Seventy-eight per cent of capacity was utilized and for the first time since February, 1946, stocks show an increase over the previous month's total. November 30, 1946, stocks of 7,830,000 bbl., however, are 39 per cent below that reported for the corresponding month of 1945. Mill shipments totaled 14,803,000 bbl. in November, 1946, an increase of 43 per cent over that reported in November, 1945. Demands for cement in November, 1946, although less than the previous month, remain relatively high and do not follow the usual seasonal trend. Demand was higher in all but two districts in the continental United States than in November, 1945. Increases range from 22 per cent in Alabama to 139 per cent in the western Pennsylvania and West Virginia area. The long-term trend in production of finished cement continues its upward trend and has reached a total of 159,020,000 bbl. for the twelve-month period ending November 30, 1946, a figure comparable with October, 1941, total of 159,181,000 bbl.

The following statement gives the relation of production to capacity, and is compared with the estimated capacity at the close of November, 1946, and of November, 1945:

RATIO (PER CENT) OF PRODUCTION TO CAPACITY

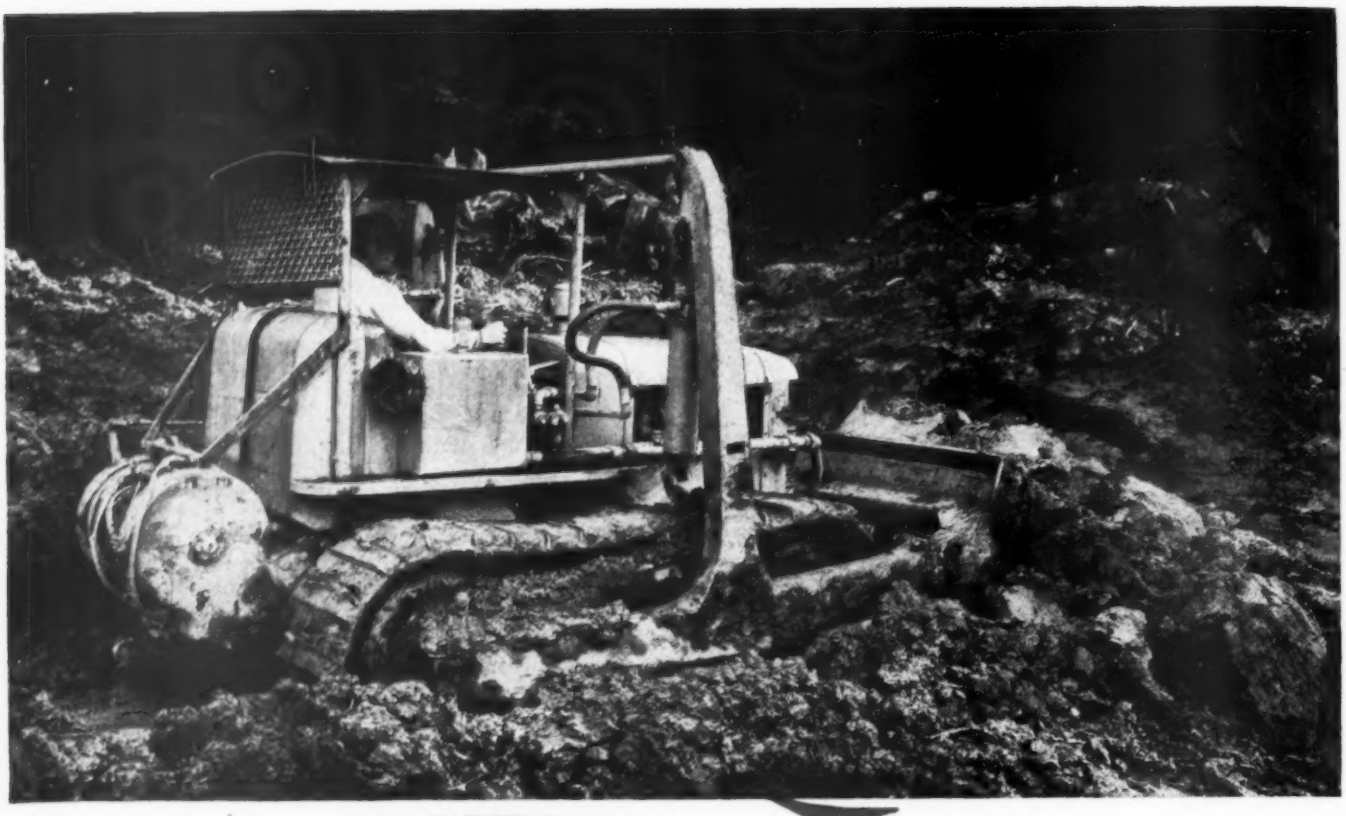
	Nov. 1946	Nov. 1945	Oct. 1946	Sept. 1946	Aug. 1946
The month ..	78.0	54.0	81.0	83.0	79.0
12 months ...	66.0	42.0	64.0	62.0	59.0

Pavement Yardage

AWARDS of concrete pavement for December and calendar year 1946 have been announced by the Portland Cement Association as follows:

SQUARE YARDS AWARDED

	Dec. 1946	During Calendar Year 1946
Roads	1,661,192	24,620,113
Streets and Alleys ...	589,658	12,129,582
Airports	54,865	2,820,883
Total	2,305,715	39,570,578



JOBS LIKE THIS...

prove the value of the lubricant that Seals out Dirt and Moisture

GOODBYE bearings if that mud ever works its way into them! Put *Texaco Marfak* into a bearing and here's what happens –

Marfak stays where you put it. It doesn't squeeze out when the load is heavy, doesn't jar out when the going is rough. *Marfak holds together.* It clings to the bearing – guards it with a persistent lubricating barrier against dirt and moisture. It protects parts better, longer, with fewer applications.

In wheel bearings, use *Texaco Marfak Heavy Duty.* Here the secret of long-lasting protection is *Marfak Heavy Duty's* ability to form a fluid lubricating film inside the bearing while retaining its original consistency at the outer edges – thus sealing itself in, sealing out dirt and moisture.

Best testimonial to Marfak effectiveness is this fact: *More than 250 million pounds of Marfak have been used to date!*

Use the Texaco Simplified Lubrication Plan for contractors' equipment. For information, call the nearest of the more than 2300 Texaco distributing plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

GET FULL ENGINE POWER

Your heavy-duty gasoline and high-speed Diesel engines will run more efficiently and deliver more power when lubricated with oil that keeps them clean — *Texaco Ursa Oil X***. Made especially for this service, *Ursa Oil X*** is fully detergent, dispersive, and has high resistance to oxidation. It keeps rings free, assuring better compression and combustion — great power and fuel economy. It protects bearings from corrosion, greatly reduces engine wear and maintenance costs.

TEXACO

TEXACO Lubricants and Fuels

Tune in . . . TEXACO STAR THEATRE presents the NEW EDDIE BRACKEN SHOW every Sunday night. METROPOLITAN OPERA broadcasts every Saturday afternoon.

INDUSTRY News

Build Crushing Plant

THE ARMENA LIME AND FARMS, INC., located in Lee County, Georgia, 11 miles northwest of Albany, is building a $150,000 limestone crushing plant which will be ready around the middle of February. It will have a capacity of 1000 tons per day as compared with the present 150-ton capacity. In addition to agricultural limestone, the plant will produce "chicken grits" and what has been termed "calcium dust." The plant was designed by E. Lee Heidenrich, Jr.

Officers of the company include: Dermot Shemwell, Sr., president; Dooley Culbertson, vice-president and treasurer; and Wade C. Moody, vice-president. The company started in 1939 with a capital of $2500 and a 20 ton daily production.

Marquette Buys Two Plants

Two southern cement plants have been purchased by Marquette Cement Manufacturing Co., Chicago, Ill., but they will continue to be operated under their former names and with essentially the same personnel. These plants, Hermitage Portland Cement Co., Nashville, Tenn., and Cumberland Portland Cement Co., at Cowan, near Chattanooga, Tenn., each have a rated total annual clinker production capacity of 900,000 bbl. Standard portland, high-early-strength, air-entraining and masonry cements are produced.

To provide a better quality of limestone for the Hermitage plant, the quarry of Middle Tennessee Stone Co., at Martha, Tenn., has been purchased, and the old sources of stone of the cement plant will be abandoned. New officers of these companies will be announced in the *Personal News* columns of this issue. The two cement plants and quarry were purchased for approximately $4,000,000. Marquette borrowed $5,000,000 from private sources and undertakes to repay the loan at the rate of $250,000 per year for 20 years with an interest rate of 2¼ per cent for the first 10 years and 3¼ per cent thereafter.

Protest Cement Licensing

CEMENT COMPANIES in certain areas in the East are protesting against licensing regulations of the Office of Temporary Controls, Washington, D. C., which are prohibiting the export of cement except under license. Some of these cement companies point out that owing to seasonal factors demand has dropped off sharply and storage space is rapidly being filled. It is contended that licensing should be relaxed until April when warmer weather will permit local construction. One exporter reported that an application to ship 1250 bbl. of cement had been returned with a license for somewhat less than half that amount.

Going Into Hot-Mix

CONCRETE MATERIALS AND CONSTRUCTION CO., Cedar Rapids, Iowa, is going into the hot-mix asphalt business. An $80,000 plant is being built by Iowa Manufacturing Co. for delivery in April. The plant will be installed at the company's Otis quarry, and deliveries will be made within a 20-mile radius. This company is widely known as a producer of crushed stone, sand and gravel, and ready mixed concrete. President S. P. Moore, in making the announcement, said that distribution of the ¼-cent gasoline tax and prospects for revision of the Iowa assessment law promises increased attention to Iowa highways and city streets.

Up Cement Advertising

MEDUSA PORTLAND CEMENT CO., Cleveland, Ohio, has announced through O. C. Hubbard, sales and advertising manager, that it will expand its advertising appropriation by 20 per cent. Advertising has been scheduled for 37 trade papers covering every phase of the building industry and also hardware papers. Consumer advertising also will be carried in a number of leading publications.

Fire Damages Fischer Plant

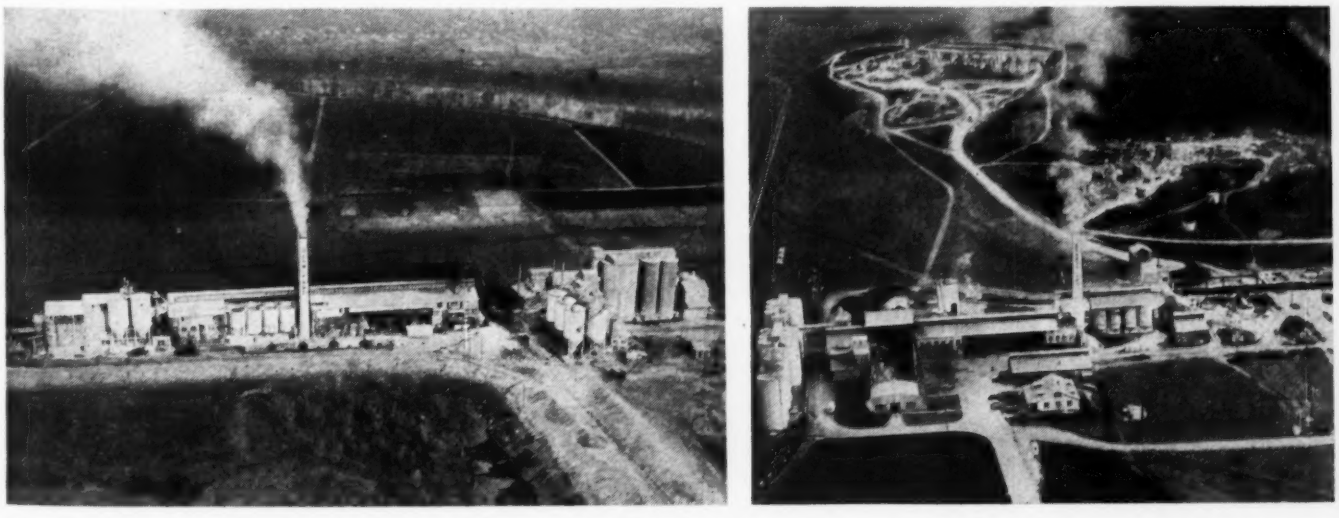
FISCHER LIME AND CEMENT CO., Memphis, Tenn., suffered a fire loss between $300,000 and $400,000 when a machine that makes expansion joints of asphalt coated felt strips caught fire when a motor short-circuited. President Lee T. McCourt said that the loss was covered by insurance.

Approve Dredge Permit

KELLEY ISLAND LIME AND TRANSPORT CO. has received a permit from the city commission of Sandusky, Ohio, to dredge for sand and gravel in Lake Erie. The areas for which a permit to dredge was requested are in Lake Erie off Sandusky, Vermilion, Lorain, and Fairport.

Start Quarry

DE HART BROS. have placed their quarry in operation just west of Excelsior Springs, Mo. Initial production is about 600 tons a day. Both agricultural limestone and road stone are produced.



Left: Hermitage Portland Cement Co. plant, located near Nashville, Tenn. Right: Plant and quarry of Cumberland Portland Cement Co., at Cowan, near Chattanooga

Organize Lime Concern

AUBURN LIME PRODUCTS Co., Auburn, Calif., has been acquired by a group of Salinas, Calif., men headed by State Senator Fred Weybret and A. C. Hughes. Senator Weybret and Mr. Hughes are president and vice-president of the new organization. John J. Taylor of San Francisco is secretary. In addition to the officers, the directors include L. K. Lacey of San Francisco and C. L. Smith of Burlingame. George L. Kelley, who has been the operating superintendent of the Permanente Metals lime operations north of Salinas, will be manager.

Said to be the possessor of one of the few high-calcium deposits on the Pacific Coast, the Auburn Lime Products Co. has had surveys made showing more than 2,000,000 tons of stone with 98 per cent calcium carbonate.

With plant machinery now being installed, the company will be able to produce 1000 tons of quick lime and 2000 tons of ground lime rock per month. Included in the new equipment is a preheater ahead of the rotary kiln to conserve heat now wasted in the stack. A hydrating unit also is to be installed.

Settle Cement Strike

LONE STAR CEMENT Co. recently signed a contract with the CIO union representing its Houston, Texas, plant employes following a 68-day strike, resulting in an acute cement shortage in this area. In addition to the wage increase, the contract provides for a scheduled week for pack house workers so the men may know in advance what days they will work and which days they will be off. The report also states that the contract carries an arbitration clause which makes the American Arbitration Association the body to appoint arbiters.

Rockwool Plant Under Way

CARNEY-PACIFIC ROCKWOOL Co., Longview, Wash., will go into production about July 1, 1947, according to Carl Heim, chief engineer of the company. Annual production is expected to be 25,000,000 sq. ft. of rock wool batts for new home insulation and 6000 tons of granulated rock wool for insulating existing homes. The plant will cost about $50,000.

Big Illinois Products Plant

THE ILLINOIS BRICK Co., Chicago, Ill., will place in operation its new concrete block plant in Blue Island within a few weeks. An inspection trip to this plant will be made by members of the National Concrete Masonry Association attending the annual meeting. Production capacity on a one-shift basis will be close to 25,000 block a day or almost 6,250,000 a year. President John Goodridge has announced that later two and three shifts will be employed as soon as workmen can be trained. The plant was built under the direction of Hugo Filippi, vice-president and chief engineer. In 1945, the company entered the concrete block business with the purchase of the Chicago Insulcrete Co., in Franklin Park.

COMING CONVENTIONS

American Concrete Institute, Annual Convention, Netherland Plaza, Cincinnati, Ohio, February 24-26, 1947.

American Institute of Mining and Metallurgical Engineers, Annual Meeting, Hotel Pennsylvania, New York, N.Y., February 16-20, 1947; 75th Anniversary Celebration, Waldorf - Astoria Hotel, New York, March 17-22, 1947.

American Concrete Pipe Association, Meeting and Convention, Statler Hotel, St. Louis, Mo., February 24-26, 1947.

American Road Builder's Association, Annual Convention, Palmer House, Chicago, Ill., February 17-20, 1947.

American Society for Testing Materials, Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 16-20, 1947.

National Association of Home Builders, Convention and Exhibition, Stevens Hotel, Chicago, Ill., February 23-27, 1947.

National Concrete Masonry Association, Convention and Exposition, Hotel Sherman, Chicago, Ill., week of February 17, 1947.

National Lime Association, Annual Meeting, The Homestead, Hot Springs, Va., May 14-16, 1947.

National Ready Mixed Concrete Association, Annual Meeting, Biltmore Hotel, Los Angeles, Calif., March 5-7, 1947.

National Sand and Gravel Association, Annual Conventon, Biltmore Hotel, Los Angeles, Calif., March 3-5, 1947.

Sand-Lime Brick Association, Annual Convention, Hotel Sherman, Chicago, Ill., February 17-18, 1947.

California Rail Rates

ROCK, sand and gravel were exempted from a recent California Public Utilities Commission order which raised intrastate rail rates to interstate levels recently authorized by the Interstate Commerce Commission. The California Commission refused to allow the flat 15¢ a ton increase on rock, sand and gravel, as authorized by the I.C.C., after hearing representatives of the Rock, Sand and Gravel Producers Association of Northern California claim that on an interstate basis this flat increase would come to about 35 per cent a ton raise rather than the 20 per cent increase intended by the I.C.C. The California Commission fixed the intrastate order to read a 20 per cent increase.

Gravel and Stone Bids

THE COLONIAL SAND AND GRAVEL Co., Mount Kisco, was low bidder on sand, cinders and trap rock to be furnished the White Plains, New York, Department of Public Works. For 2000 cu. yd. of sand, the Colonial price was $1.90 a cu. yd.; for 1500 cu. yd. of trap rock the quotation was $5300.

National Lime & Stone Co., Findlay, Ohio, and the Western Ohio Stone Co., Lima, Ohio, have quoted the City of Lima, Ohio, at $1.00 per ton for the smaller sizes as compared to 80¢ a ton in 1946. Up to $1.60 was quoted for the larger sizes, a raise of 20¢ a ton over a year ago. The Churchill Construction Co., bid $5.65 and $5.75 per ton for two types of T-35 hot mix while the McClain-Fritchie Co. bid $5.25 for a T-34 cold mix.

Big Ohio Lime Backlog

OHIO'S LIME INDUSTRY centering at Gibsonburg and Woodville is running four to six months behind schedule, due to lack of help, according to a statement by Sanford G. Price, president of Gibsonburg Lime Products Co.

Add Long Kiln

NORTH AMERICAN CEMENT Co., Alsen, N. Y., plant will replace some of its old equipment with a new kiln which will be 340 ft. long and have a diameter of 10½ ft. Stone and Webster is in charge of the construction.

Sells Gravel Business

MELVIN ALDRICH, Baudette, Minn., has purchased the gravel and trucking business of Emil Olson and his son Clifford. The sale included a 40-acre gravel pit and deposit. Mr. Olson is leaving for Bend, Ore.

Gravel Plant Fire

OHIO GRAVEL Co., Cincinnati, Ohio, suffered a fire loss of about $20,000. Machinery and a portion of the bins and conveyor system were destroyed.

Midwest Agstone Meeting

AT THE ANNUAL MEETING of the Midwest Agricultural Limestone Institute which was held at the Edgewater Beach Hotel, Chicago, Ill., in connection with the National Crushed Stone Association meetings, the following officers were elected for the ensuing year: Horace Krause, president; George Hammerschmidt, vice-president; Harry Clark, treasurer; and Floyd Mumma, secretary.

A special meeting of the Midwest Agricultural Limestone Institute was held on December 5, at the Abraham Lincoln Hotel, Springfield, Ill., to consider matters requiring immediate attention. FLOYD MUMMA, secretary, presented the minutes of the last meeting, and outlined the purpose of the special meeting.

WILLIAM CARTER, president of the National Stone Co., Joliet, Ill., who recently was elected vice-president of the Institute, succeeding Dan Sanborn who is no longer identified with the stone industry, served as acting president.

HARRY A. CLARK of the Consumers Co., Chicago, and treasurer of the Institute, presented new by-laws, largely patterned after the national association, which were adopted.

W. E. SCHMIDT of Columbia Quarry Co., brought up the question of percentage depletion for the crushed stone industry and distributed mimeograph copies of the Rich bill which originally proposed a seven per cent depletion for limestone deposits. However, the bill finally approved omitted limestone entirely on the grounds that deposits were plentiful. It was brought out in the discussion that deposits of coal also were very extensive, but the coal industry obtained a five per cent depletion. A resolution was offered that the National Crushed Stone Association be urged to take early action in presenting the request for adequate depletion charge for the industry before the next Congress. Deposits of good quality stone within economical hauling distance are in many areas being exhausted very rapidly, and this should be taken into consideration.

A resolution was presented, expressing the loss to the Institute in the death of E. J. KRAUSE who was for many years its president and moving spirit, which acting president Wm. Carter was instructed to draw up and present to the family.

The following were in attendance:

Wm. Carter, National Stone Co., Joliet
Harry Clark, Consumers Co., Chicago
Horace Krause, Columbia Quarry Co., St. Louis
W. E. Schmidt, Columbia Quarry Co., St. Louis
Floyd Mumma, Columbia Quarry Co., St. Louis
Paul Theisen, Black-White Limestone Co., Quincy
Wm. J. Stoffel, Dolese & Shepard Co., Chicago
M. McLean, East St. Louis Stone Co., East St. Louis
Wm. E. Hewett, East St. Louis Stone Co., East St. Louis
Quentin Grammer, East St. Louis Stone Co., East St. Louis
R. S. Torgerson, ROCK PRODUCTS, Chicago (Guest)

Merge Cement Companies

GENERAL PORTLAND CEMENT CO., Chicago, Ill., will be the name of a new cement company to be formed by a merger of the Signal Mountain Portland Cement Co., with a plant at Chattanooga, Tenn., the Florida Portland Cement Co., with a plant at Hookers Point, Fla., and Trinity Portland Cement Co., with plants at Dallas and Fort Worth. Special stockholder meetings for February 17 have been called by the respective companies to act on the proposal. These companies are allied now under the same general officers with headquarters in Chicago.

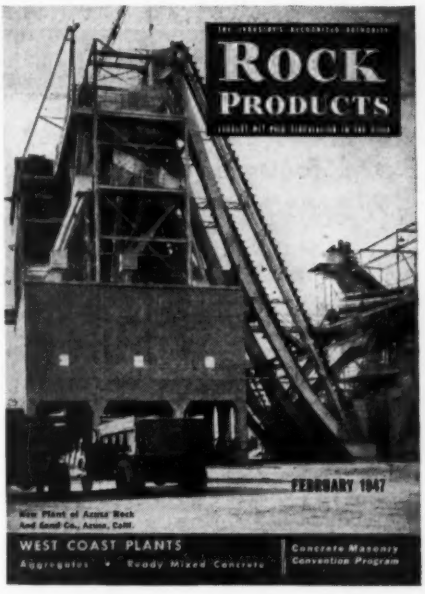
General Portland Cement Co. will have an initial capitalization consisting of about 1,000,000 common shares and purchase warrants. Trinity, with currently outstanding capital stock of 17,500 shares of $100 par, would receive 29.3171 shares of new common in General Portland for each share under the consolidation plan. Florida Portland has outstanding 49,971 shares of $100 par preferred and 74,985½ shares of no par common. For each share of preferred it would receive 6.4117 shares of General Portland common, and for each share of present common, a warrant to purchase one-sixth share of General Portland common. Signal Mountain, with outstanding capital stock of 18,899½ shares of $100 par preferred and 29,982¾ shares of no par common, would receive 8.8126 shares of General Portland common for each preferred share and a warrant to purchase one General Portland common share for each Signal Mountain common share held.

New Brazil Cement Plant

THE COMPANHIA CIMENTO BRASILEIRO, organized in Sao Paulo, Brazil, early in 1944, is completing construction of a small dry process cement plant at Esteio, in the State of Rio Grande do Sul, about 20 km. from Porto Alegre. Operations are expected to start in February, with a production of 25,000 to 30,000 bbl. of portland cement per month. Dr. Conrado Barsotti, Jr., who has been working for Lone Star Cement Corporation in the Argentine and Brazilian plants since 1932, will become connected with the new company. Sr. Armando Bei, industrialist and business man, is director-superintendent of the company.

Monarch Improvements

WALTER H. WULF, president of the Monarch Cement Co., Humboldt, Kans., has announced a large scale rebuilding program for the plant to be carried out over a period of several years. The machine shops will be one of the first units to be overhauled. A new rotary kiln to treble the capacity of the kilns now in use has been ordered.



Front cover of this issue shows unique belt bucket installation at Azusa Rock and Sand Co., Azusa, Calif.

Kentucky Stone Association Elects New Officers

KENTUCKY CRUSHED STONE ASSOCIATION recently held its annual meeting at Lexington and elected a new slate of officers. W. S. Stone, Princeton, Ky., was elected president, succeeding Verne C. Morgan. Other officers elected were: Bruce Isaacs, Lexington, vice-president; J. R. Thompson, Frankfort, treasurer; and Mrs. S. D. Pace, Burkesville, secretary.

Portal-to-Portal Suits

SEVERAL cement and gypsum companies have had suits filed against them for portal-to-portal pay by CIO unions. Lone Star Cement Corporation, Houston, Texas, plant employes filed one of the most recent suits. An interesting angle is the suit filed against the National Gypsum Co., by former employes of the Bluebonnet ordnance plant at McGregor, Texas. Since National Gypsum Co. was a cost-plus war plant contractor, the federal government will defend the suit.

Resume Operations of Leased Cement Plant

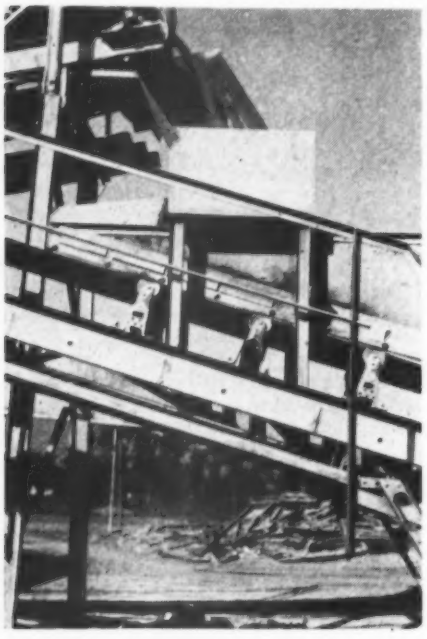
PACIFIC COAST CEMENT CO., Seattle, Wash., has announced that it has resumed operation of its plant at 3801 East Marginal Way, Seattle, which has been under lease to Superior Portland Cement, Inc., Seattle, Wash. Known as the Diamond cement plant, the company announces that cement will be manufactured and sold as Diamond Brand Cement.

HINTS and HELPS

PROFIT-MAKING IDEAS DEVELOPED BY OPERATING MEN

Extra Troughing Rolls

WHEN CRUSHING in closed circuit with a screen, the oversize must be returned to the crushing circuit. Common practice is to return the oversize via a suitable belt conveyor to



Install additional troughing rolls where oversize rock is returned to main belt

the main feeder belt. Where this rock falls onto the main belt additional troughing rolls should be provided at closer spacing. It's a little point but quite often it is ignored or overlooked. Try putting in an extra troughing roll or two at these greater-pressure or greater-load points and see if it doesn't make for a longer lasting belt and smoother operations with less spillage.

Unusual Concrete Walls Divide Stockpiles

LAST YEAR the Pioneer Sand and Gravel Co., at their Steilacoom plant (near Tacoma, Wash.) built a series of unusual concrete walls to separate adjoining stockpiles of sand and gravel. The company is now building ten more of these novel walls for additional finished storage space.

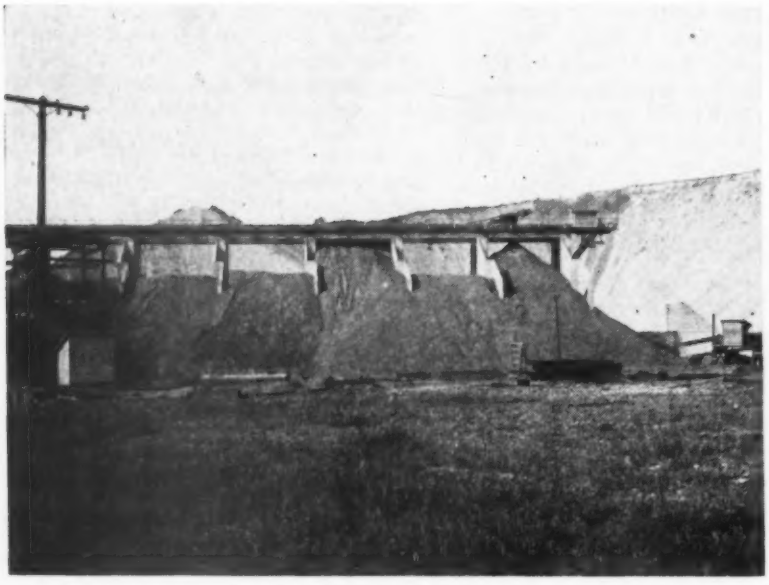
It was desired to have 1000 tons of live storage for each size of sand and gravel, crushed gravel, etc. The sand storage piles are of the same size as the rest, but the live tonnage is only slightly above 800 tons owing to the inherent nature of that product. The assembly is so designed that a belt conveyor with an unloading shuttle operates on a track over the piles with a reclaiming tunnel and belt below.

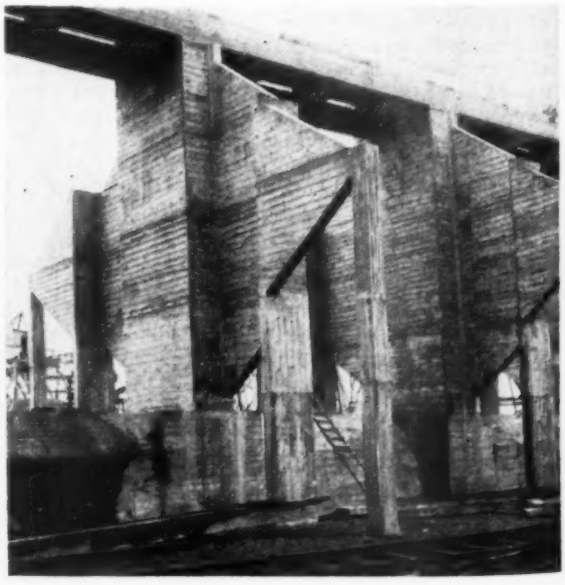
In each of the ten pockets there are no cross braces, ties, or struts from wall to wall to interfere with the free flow of material. The walls are all 12-in. thick and are reinforced with ⅝-in., hard, deformed bars in the tunnel section and ½-in. bars in the remainder for both vertical and horizontal reinforcing. The walls are spaced on 30 ft. centers. To get the desired tonnage within this limit called for a total height of about 40 ft. A straight concrete wall of such height would call for some additional bracing due to the unbalanced side stresses set up when one compartment was full and the adjoining one empty. To get around this difficulty the walls were stiffened by offsets (or folds) at right angles every 11 ft. This amounted to having four "Z" beams in each wall. These offsets are 4 ft. in length. The walls as a unit resemble a diamond standing on its tip with the top section following approximately the angle of repose of the stored material.

The designer, Homer M. Hadley, formerly regional structural engineer with the Portland Cement Association, Seattle, Wash., felt there was no need to carry the wall sections all the way down so he terminated them at a point to allow about 2 ft. of embedment in the dead stored material. Only the "Z" or offset portions extend to the ground and these act as columns.

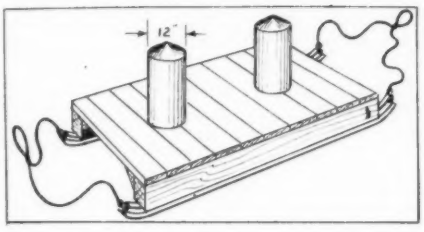
Power Cable Sled

ONE of the principal sources of breakdown and delays on an all-electric shovel or dragline is power cable maintenance. At the National Lime & Stone Co. quarry at Carey, Ohio, this problem has been met successfully by using a cable sled. This sled was designed and fabricated at the Carey plant and offers a relatively simple preventative against cable abrasion of the 1500-ft. length of rubber covered power cable. Two 12 in. dia. cylindrical cone-topped posts are welded on a steel 6- x 12-ft. platform having two 60-lb. railroad rail runners turned up at both ends to facilitate moving in either direction. The posts are centered on the platform 30





Left: Reinforced concrete walls separating stockpiles are of unusual design. Right: Closeup showing "diamond" shape and offsets to take unbalanced side stresses when one bin is full and the other empty



Illustrations showing how shovel cable is carried on steel sled to prevent abrasion

in. apart, and the cable placed in a figure 8 alignment circling the posts. The shovel helper rides the sled and pays out or takes up the cable as the sled is pulled along by a steel cable hooked onto the shovel undercarriage.

Rock Puller

SHOWN in the accompanying illustrations is a pneumatic piston that has been installed at the Rockton, N. C., plant of the Bryan Rock and Sand Co., to assist in freeing oversize pieces of rock that become lodged in a primary gyratory crusher. The piston, secured to the boom of a stiff-leg derrick, is attached to the end of a chain that runs through a pulley at the end of the boom immediately above the crusher. A hook on the end of the chain engages the rock when the piston is out, and raises the rock when the piston is drawn into the cylinder.

Concrete Vibrator

By H. W. WILKISON

AN EFFECTIVE VIBRATOR for placing concrete in pipe molds when the commercial variety may not be available can be made from scrap pile materials.

Materials comprise a tractor sleeve cylinder and piston with connecting rod. A plate is placed across the top to which two pillow block bearings are attached for a crank or cam shaft. The "crank" is turned from a large bar so as to give the desired stroke of the piston. We use one-inch. The connecting rod will probably have to be shortened. This assembly is driven with a flexible shaft or a rod and a pair of universal joints. Two points for attaching chain completes the outfit. Speed of the cam shaft is 3500 r.p.m. or more.

Adjustable Split Discharge

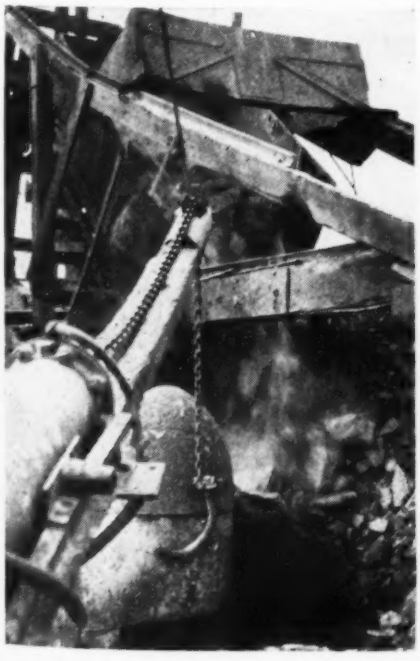
GROVE STONE AND SAND CO., Swannanoa, N. C., has installed an adjustable chute at the discharge end of a belt conveyor that permits feed to the main plant or to a newly-installed portable plant in any amount desired. Raw material is crushed and discharged to the belt conveyor for delivery to the split discharge where the product can be sent to the main plant by tilting the chute.

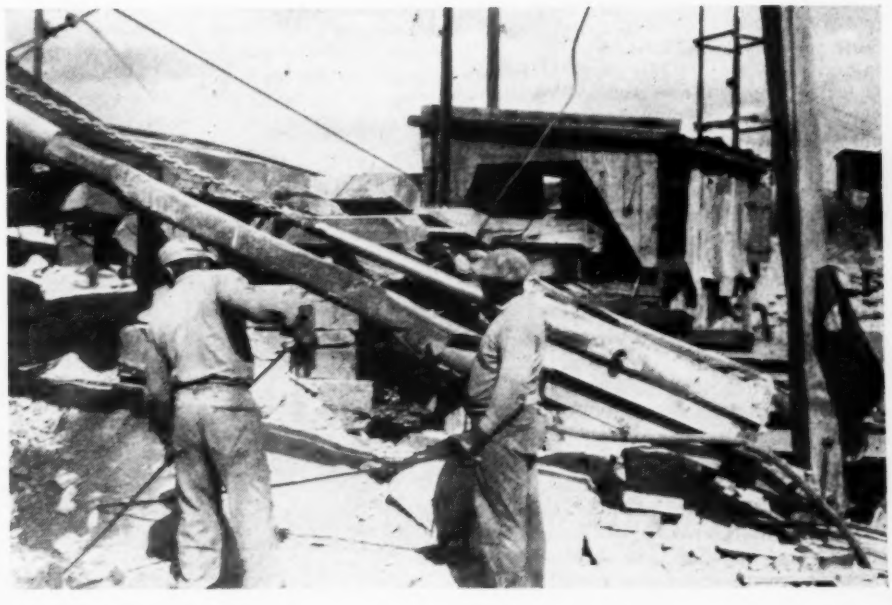
This chute is supported on a steel rod acting as a fulcrum and the chute can be tipped by a lever to divert the entire flow to the main plant. When the chute is tipped in the opposite direction, half of the discharge from the conveyor goes to the main plant and the other half to the portable plant. In the event that the entire flow is to be sent to the portable plant, an extension is slipped on the chute, and the entire flow is diverted to the portable plant. The accompanying illustration shows the position in which the chute is placed relative to the discharge point of the belt conveyor.

Chute can be tilted to left or right by lever. In present position, the flow is half to each plant. When tipped to the right, the entire flow is to the main plant. To send entire flow to portable, extension is attached to chute

H. HUDSON PRICE, Luray, Va., is constructing a concrete block plant that will produce 2000 block per day when completed.

To the left and below: Pneumatic piston on boom of derrick is used to dislodge oversize rock in gyratory crusher

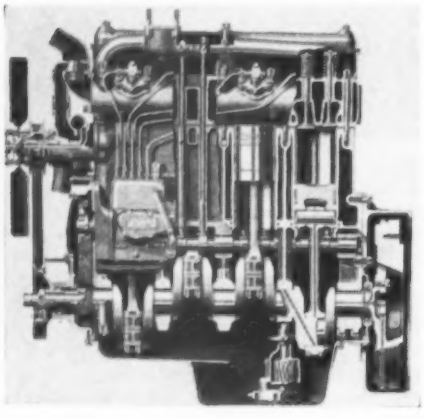




new MACHINERY

Heavy Duty Diesels

INTERNATIONAL HARVESTER CO., Chicago, Ill., has started production on a 125-hp., Model UD-18A power unit and a 76-hp., Model UD-14A power



Sectional view of 4-cylinder Diesel engine

unit. Both units are heavy-duty, four-cycle Diesels with the same bore and stroke, but the UD-18A has six 4¾-x 6½-in. cylinders, and the UD-14A has four. The UD-18A and UD-14A deliver in full measure considerably more power without increase in weight over the UD-18 and UD-14 models which they displace.

Improvements announced by the manufacturer include a new cylinder head arrangement, improved nozzles, and redesigned precombustion chambers to give them higher compression and greater efficiency in converting fuel energy into low-cost power. No preheating of incoming air in cold weather is required. The integral gasoline starting system has been retained in the UD-14A and UD-18A Diesels. Engines are started on gasoline in the same manner as an ordinary gasoline engine. After a brief direct-flame cylinder warm-up, movement of a single lever changes the engine from the gasoline starting cycle to four-cycle Diesel operation with compression ignition.

Electric Mine Locomotive

GENERAL ELECTRIC CO., Transportation Division, Schenectady, N. Y., has designed a 25-ton, 480-hp., high-speed electric mine haulage locomotive for fast haulage over long runs.

It is of all-welded steel construction, and has a top speed of 40 m.p.h. Two 2-axle swivel trucks provide four-axle distribution of locomotive weight to reduce load and lateral force wear on trackage. Short rigid-wheelbase trucks, with low inertia and swivel connection to the frame, allow free wheel tracking, and minimize binding and strain on both locomotive and rails. Short end overhang in relation to distance between body support points prevents teetering or galloping at high speed.

Each axle is driven by a 120-hp., 250-volt heavy-duty traction motor with frames of modern rigid one-piece box-type construction. Another advantage claimed by the manufacturer is that sparkless commutation over the entire range of load conditions assures long brush life and low commutator maintenance. Motor-powered blowers provide complete traction motor ventilation. At the continuous rating of the traction motors, the locomotive develops 12,500 lbs. tractive effort which is equivalent to 25 per cent adhesion. Rated drawbar pull is 12,500 lbs. at a speed of 11.5 m.p.h.

Handling Unit Loads

CLARK EQUIPMENT CO., Battle Creek, Mich., has developed a method of simplified material handling, with unit loads mounted on disposable carrier sheets of corrugated paper board, fibre board or other material instead of wood or metal pallets.

Known as "Pul-Pac," it is a combination of a push-pull attachment for Clark forklift trucks, with a flat steel plate serving in place of conventional forks. A hydraulically actuated gripper device moves forward, clamps an extending margin of the carrier sheet and pulls sheet and load onto the plate. At destination the load is lifted and registered directly over the area onto which it is to be deposited, and the pusher device, working against the load, deposits the carrier sheet and its cargo in the exact position as the backing truck withdraws the carrier plate. This equipment may

Lift truck with Pul-Pac attachment for stacking packaged materials on corrugated or fibre board pallets

have an application in handling lime, cement and other rock products in bags.

Small Stripper

R. G. LETOURNEAU, INC., Peoria, Ill., has added a small Tournapull, Model D, for high speed dirt-moving. It is powered by an 85-hp. gasoline engine, and is equipped with the new E-4 Carryall scraper, having a load limit of 4 tons and a struck capacity of 3.3 cu. yd. The unit is self-loading, has four speeds forward, four reverse, and travels up to 23 m.p.h.

A feature of this unit is a new electric control by individual electric motors, an operating principle which replaces conventional tractor steering and gear shift levers, according to the manufacturer. It is also said to eliminate the need of a power control unit for scraper operation. The operator steers, shifts and handles all scraper

High speed, electric mine locomotive

controls by buttons on the electric control panel.

Another feature is a differential which keeps both wheels pulling at

Electrically controlled haulage unit

all times. Its design is such that on slippery going the most power is supplied to the wheel on firmest footing. It is also easily maneuverable, with ability to turn in its own length, 22 ft. 5-in.

Magnetic-Field Gage

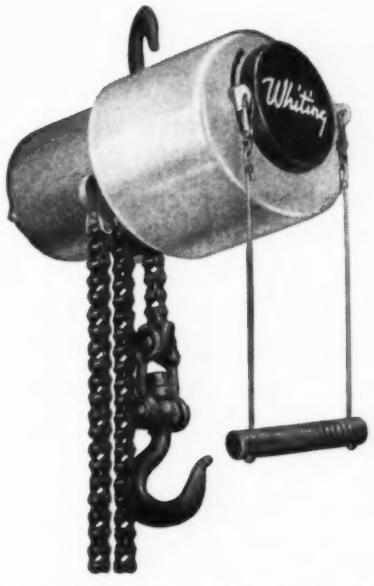
GENERAL ELECTRIC Co., Schenectady, N. Y., has developed a magnetic-field gage which indicates the relative strength of the magnetic field in parts which are being examined for flaws by the magnetic-particle method of testing. The new instrument is said to be especially useful for testing large castings and forgings in which it is difficult to calculate the field intensity at various points from the current passed through the part and the cross-sectional areas. In testing parts for flaws with the magnetic-particle method, a magnetic field is first set up in the part. Then magnetic particles are distributed over the surface of the part, and these line up along any crack or flaw.

Bulldozer Shovel

THE FRANK G. HOUGH Co., Libertyville, Ill., has announced its Model 9-A bulldozer-shovel built into the International T-9 and TD-9 TracTracTor. The Model 9-A is a dual purpose unit, and may be equipped with either a full track width 1-cu. yd. bucket or bulldozer blade. Hydraulic control raises, lowers, dumps and relatches the bucket, eliminating practically all physical effort on the part of the operator. The bucket tilts back automatically in carrying position preventing spillage. A long, high dumping reach is provided for dumping into trucks, hoppers, etc., and the design of the push-arms provides a powerful crowding action in digging range and fast hoisting action, according to the manufacturer.

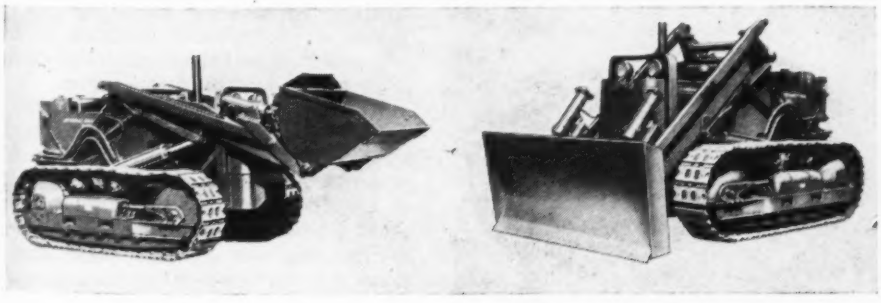
Portable Electric Hoist

WHITING CORPORATION, Harvey, Ill., has announced a new line of roller-chain electric hoists of 14, ½, and one-ton capacity. The one-ton hoist, which is said to weigh only 87 lb., utilizes a simple, double-reduction, totally enclosed, worm-gear drive. The hoist frame is a steel casting, and the load is carried on steel from hook to hook.



Hoist having load hook which swivels on ball bearings

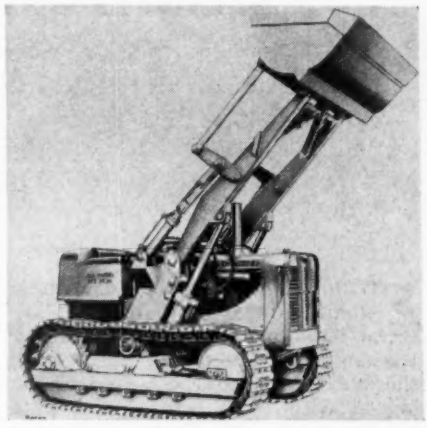
A patented self-energizing motor brake interlocks with the controller to provide safe operation. Upper and lower safety limit switches are provided. The hoist can be operated in an inverted position which is said to be an advantage where the overhead suspension point is high. Instead of carrying the hoist to the point of suspension, the cable is run out to the desired length, hoist is turned upside down, and suspended from the hook. The load is then attached directly to the hoist.



Left: Tractor equipped with bucket. Right: Tractor fitted with bulldozer

Tractor Shovel

TRACTOMOTIVE CORPORATION, Findlay, Ohio, has brought out its Model TS-5 Tracto-Shovel, a shovel for use on the Allis-Chalmers HD-5 long



Tractor equipped with shovel which also may be fitted with bulldozer blade

track, rigid truck frame Diesel tractor. This shovel equipment has a hydraulically-controlled bucket operated by double-acting lift and dumping cylinders. These cylinders are designed to provide adequate down pressure and controlled dumping and closing of the bucket. The manufacturer states the bucket can be dumped or closed at any height, quickly or slowly, and has an automatic tilt-back to prevent spillage. Tractor-width buckets of one cubic yard capacity are standard equipment, with bulldozer blades or special buckets optional. Shovel frames are mounted directly to the tractor and contain a 25-gal. capacity oil reservoir. Overall length of the tractor-shovel is 14 ft. 6 in., the width is 6 ft. 3½ in., and the height, with bucket down, is 5 ft. 11⅝ in.

40th Truck Anniversary

INTERNATIONAL HARVESTER Co., Motor Truck Division, recently celebrated its fortieth anniversary in truck manufacturing by a preview of International trucks at Fort Wayne, Ind., on January 17. The exhibit included some of the early models and a display of its latest KB line, and the Western models or 6 W. There are a number of International KB models, ranging in gross vehicle weight ratings from 4400 to 48,000 lbs., for the largest 6-wheel type, known as the KBR-11-F. The Western models, built at the Emeryville, Calif., works, have ratings ranging from 30,000 to 90,000 lbs., but four are off-highway models.

Record Chart Legibility

BAILEY METER Co., Cleveland, Ohio, recently introduced recorder charts printed in neutral gray. It is said that this makes it easier for operators and supervising engineers to read the charts because of the greater emphasis given the various colored records by the neutral background.

Business Booming In the West

Aggregates producers building many new plants to meet the demand, but "growing pains" involve problems

By WALTER B. LENHART

This review of business conditions on the West Coast and the articles which follow on new plants on the Coast were prepared by the author from information gained on an extended tour through this area. Several of the plants scheduled for convention inspection trips are described and illustrated

SITTING in the office of a western manufacturer of mining and material handling equipment talking to the manager, I noted in the yard of the plant a large truck and trailer loaded with boxes, crates and what not. A small ball mill made up part of the load. "That load," said the manager, "is going to Russia. A large part of our business is in the Philippines and Asia."

For years the West Coast took its export business as a matter of course. Little attention was paid to this possibility, but during the war business awoke to the possibilities of trade from the Orient, the islands of the Pacific and the West Coast of South America. This is only one of the many reasons why the West Coast is continuing its industrial and community growth that reached another of its many peaks during the war. There would be more building but the Coast is short of most everything in the construction line. Interwoven with the possibilities of making a profit is the desire to live on the Coast. Portland cement is hard to get even to the bulk users. With the paper shortage, sacked cement is in even shorter supply. Material dealers welcomed the recent unseasonable rains in Southern California for it slowed up construction but did not affect cement production.

Showing large capacity haulage equipment at El Monte plant of Graham Bros.

There is probably more than an average amount of highway work going on but contractors are keeping in the background, not wanting to stick their necks out with material costs sure to rise, and labor costs rising or at best unsettled. The smart contractor is not taking any large contracts for road work unless he adds an extra amount for contingencies, as high as 40 per cent according to one authority. If highway work was leading the construction parade, private building would suffer for there is just not enough aggregate and other materials available. In the Los Angeles area all the sand and gravel producers are working (December-January) either two 8-hr. shifts or on a 12-hr. basis. Gypsum products are at a premium. Similar statements could be said for the San Joaquin Valley section, the San Francisco and Bay districts, and so on into Oregon and Washington.

With any industrial and community growth naturally comes an increase in traffic. Los Angeles has the highest traffic density of any city in the world and something has got to be done. The same can almost be said for any of the larger cities on the Coast. California alone has 2,300,000 registered vehicles and with the relaxing of automobile travel restrictions, almost countless "foreign" cars are on its highways. About one out of six cars appears to be an out of state car. The problem of traffic density has become so serious that Governor Warren of California called (during January) a special meeting of the State Legislature to consider a two billion dollar program that was outlined in the report to the Collier Fact Finding Committee. To finance this long range proposal the present gas tax of 3¢ per gal. will be raised; probably to as high as 6¢ according to reports.

California has a little less than 14,000 miles of paved road of which over 5000 miles is less than 20-ft. wide. A large part of the remainder is the "death trap," three-lane highway. The newer roads are four-lane, divided highways. Until these highways are modernized the state can be expected to continue to pay a high toll of traffic fatalities, which for the

Overall view of El Monte plant of Graham Bros., one of the modern plants which is on the convention visiting schedule

past two years have exceeded the combined traffic deaths of New York and Pennsylvania.

If this program goes into effect not only will gas taxes be raised but there is some talk of changing the method of truck taxes—changing them upwards. As the bulk of sand and gravel sold in the Los Angeles area is delivered by trucks with producers owning huge fleets of trucks, this increased tax is worthy of consideration.

In addition to building, further development of hydro- and steam-electric power is going forward. One large electrical utility is spending upwards of $25,000,000 for additional hydro-electric generating capacity on the North Fork of the Mokelumne River; additional water storage facilities on the Pit, Russian, and Mokelumne; the construction of a large steam-electric plant at Bakersfield and other miscellaneous construction work will be pressed. The vast network of canals of massive concrete for completion of the Central Valley Project in the lower Sacramento and San Joaquin valleys also is going forward.

Zoning Problem

With this sprawling industrial growth comes another problem to the producers, that of zoning. Sand and gravel producing centers on the East and to the West of Los Angeles were at one time, not long ago, well out of the city, but the industrial and community expansion has enveloped them so that zoning ordinances may restrict the future productivity of the area. This problem of metropolitan producers probably will receive some consideration at the coming National Convention.

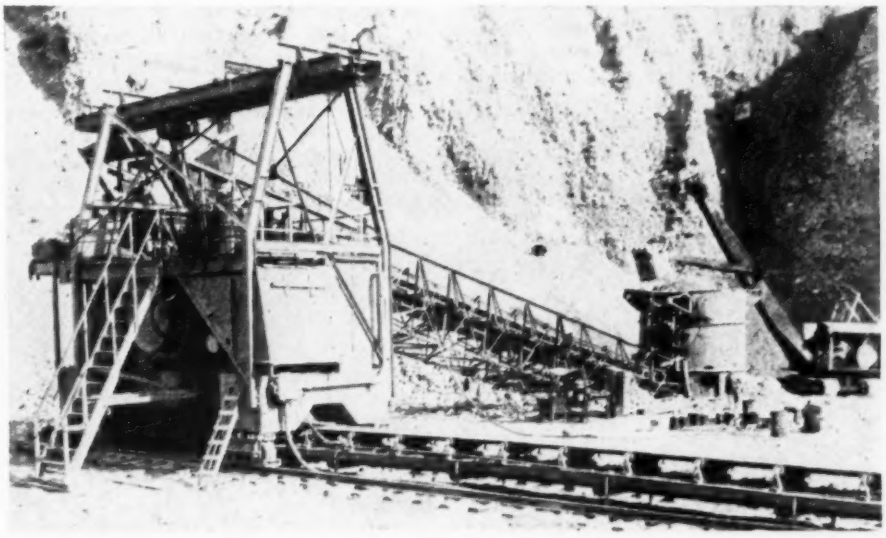
Another "Pain in the Neck" to the Los Angeles producers is the so-called "Smog," a combination of smoke and fog, and the citizenry of LA are up in arms about it. People living in the East are used to smoke for it is more or less a result of coal burning. But westerners, particularly those on the Coast are used to natural gas and oil for all fuel needs both for the home and for industry. Laws have been passed against the so-called smoke nuisance and many of the larger industries have been indicted for violating the law. Switching engines around aggregate plants are being watched by Smog Inspectors. Diesel trucks that announce their presence by billows of black smoke, and the many "hot plants" for preparing black top road material also have been sources of complaints. But these problems must be met half-way for the growth of any city is directly proportional to its concrete availability. Stop or hinder the production of sand and gravel and you stop city growth. Shackling it with unnecessary restrictions only adds to the cost of the material. Restricting areas by zoning will lessen an already shrinking supply of aggregate, for commercial deposits of sand and gravel in the Los Angeles area decidedly are not plentiful, and in the San Francisco area they are scarce and far afield from the hubs of industry.

Workers in the various aggregate plants seem to be well satisfied. They are unionized to a high degree. However, there is some talk of the plant engineers kicking up a fuss that probably will result in a strike. However the average plant worker is getting in so much overtime at time and one-half that his earnings are at war levels so he is satisfied.

When the OPA lifted its ban on construction materials there was no immediate rise in prices any place on the Coast that could be discovered, but at the turn of the year prices of ready-mixed concrete and aggregates were expected to rise slightly to offset the increased production costs.

Plant Expansion Programs

However, many of the larger producers have been expecting these increased costs and have entered into a broad program of rehabilitation and plant construction to meet these costs, and to take care of the business now at hand and that which is sure to follow during the next few years. One of the leaders in this group is the Pacific Coast Aggregates Co., Inc., of San Francisco with a $3,000,000 expansion program now well under way. Two new plants, ultra-modern in design, of reinforced steel and concrete throughout, are now being constructed. One at Tracy in the Lower San Joaquin valley, which will utilize a new, huge deposit of excellent sand and gravel, replaces the old River



To the right is shovel loading field hopper at plant of John D. Gregg. Movable primary crusher may be seen to the left, the conveyor connecting the two units pivoting at the crusher end and can be swung around like hands on a clock

New plant of Pacific Building Materials Co., Portland, Ore., which will be ready about the first of March

Rock plant and will be known as the Carbona plant. It will cost about $350,000. The plant at Elliot will be much larger in capacity, and will replace the present operating plant. It will cost $1,000,000. Both units will be operating by mid-summer.

In San Francisco, this progressive company has just moved into its new office building at 400 Alabama Street, across from the yards at 16th and Harrison St. The office is a small part of the expansion program. It is a Class A, reinforced concrete building, finished in attractive blond oak, and cost $350,000. In the building are 30,000 sq. ft. of track-level warehouse, 15,000 sq. ft. of truck level warehouse, and 15,000 sq. ft. of office space. On the roof are the engineering offices and lunch room. George Hampton is chief engineer.

Recently the company took over the Grant Pacific Rock Co., and the Grant Service Rock Co. in the Fresno, Calif., district. There are two plants there now. The Rockfield plant at Friant that supplied aggregate for the Friant dam is being rebuilt with steel, and will be completed in April, 1947. A plant at Lindsey originally built in 1935 comes into the deal along with various other non-operating deposits and old plants not operating.

Distribution yards are being expanded and enlarged to handle building materials, wallboard, steel, paints, etc. Aggregate bunkers, ready-mix plants, and "hot plants" are being built at yards where none existed before. New yards such as at East Oakland, Richmond, Sacramento, and San Jose are being established, and by the Spring of 1947 the company will have 12 of these distribution units in operation. A batching plant and also a "hot plant" were recently set up at Fair Oaks.

Under construction by the company at Elliot, in the Livermore, Calif., district is a new plant which will be far enough along for convention guests to get a good idea of the nature of this large-scale and novel operation. Livermore is about 25 miles east of Oakland. Material will be removed from the pit to a depth of 110 ft., and delivered to the scrubbing section of the new plant by a 42-in. conveyor belt. An 8- x 30-ft. scrubber will be used. Excess pea gravel so prevalent in the district will be scalped out early in the processing, and will be ground to sand in a center discharge Marcy rod mill of large capacity.

The use of a center discharge rod mill is somewhat an innovation. The rod mill will be fed from both ends and discharged from openings in the shell near the center. Rod mills do most of their grinding (upwards of 95 per cent) at the feed end so rod wear is greatest at this point. Using short length rod mills tends to "snarl" up the rods. By feeding at both ends, the full length of the grinding rod will be better utilized and a much greater tonnage ground, especially when used in closed circuit with a classifier or screen. The sand will then be returned to one of the many surge piles that will be a feature of this plant. The plant will have a capacity of 6000 to 7000 tons per day.

One of the very interesting features will be the use of four or more intermediate surge piles of semi-finished material. Surge piles will have a total live capacity of from 35,000 to 40,000 tons. A much larger capacity can be had by the use of scrapers if desired. A rather involved system of reclaiming tunnels and belts will recover the material from these surge piles and deliver it separately over one of four parallel belt conveyors that will serve the screening plant. In essence there will be four separate screening plants mounted over the reinforced concrete storage bins. The reclaiming system alone will require 14 conveyor belts. In all something over one mile of belting will be used, ranging from 24- to 36-in width. The four parallel belts going to the screening plant will account for about 1600 ft. of this total. One of these belts will be 36-in. and the other three, 24-in.

Gravel in this district is not large so a type N, No. 6 Allis-Chalmers crusher will be used for the primary crusher. It will have a 12-in. opening. In the operation there will be six separate units with surge piles interposed between units in such a manner that any one (or all) of the units can run independent of the others. This wide use of surge piles is intended for flexibility in production and to maintain a steady production. A stoppage in one section will not interfere with the rest of the plant.

For secondary crushing the following Allis-Chalmers Type R crushers will be used: one No. 636, one No. 436, two No. 322, and one No. 222.

In all there will be 26 vibrating screens of which 16 will be on the crushed rock circuit. All will be Allis-Chalmers screens. There will be the following: two 5- x 10-ft., single-deck; one 5- x 12-ft., three-deck; fourteen 4- x 14-ft., two-deck, low-head; and nine 4- x 14-ft., three-deck, low-head screens.

This large plant will dominate the surrounding country. The screening plant mounted on top of the bunkers will extend some 65-ft. above the top of the bins. Most of the shipments will go out by rail. About three miles of 110-lb. rails will be installed for switching purposes. The plant will be ready to operate about May, 1947.

The plant is being constructed by the company. Walter Saxe of the Conveyor Co. is cooperating with George Hampton, chief engineer of Pacific Coast Aggregates Co., in the design and general layout of the plant. D. A. Gildersleeve is superintendent.

The second large capacity plant of the Pacific Coast Aggregates Co. is now under construction some 4½ miles south of Tracy, Calif., between Oakland and Sacramento. The plant is a little further along as regards construction progress than the Elliot plant so by the time this is published visitors can get an excellent idea of its possibilities and unusual features. It also will be ultra-modern, will use belt conveyors to a large extent, and will feature several surge piles between the pit and the final washing

General view of John D. Gregg plant showing unusual storage facilities

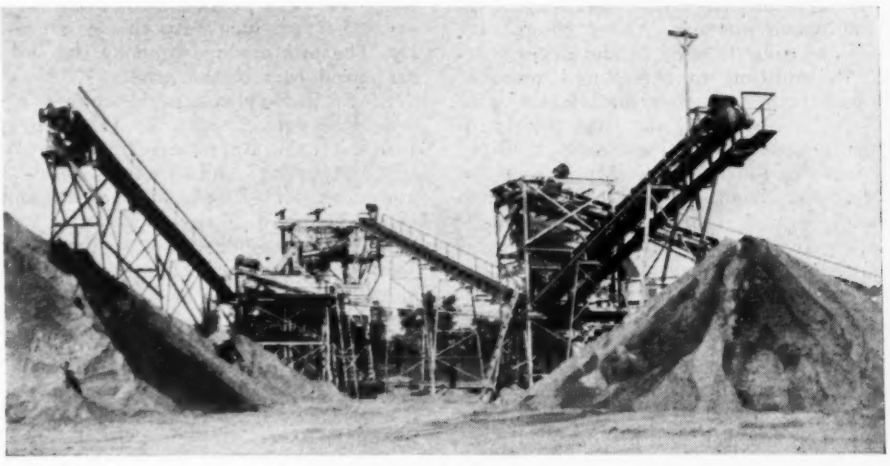
screens. The conveyors are all 36-in. and 24-in., supplied by Conveyor Co. of Los Angeles. It is of reinforced steel and concrete throughout with cylindrical steel bunkers for the washed gravel and crushed rock. The crushed rock section will be the dry section, and will have a capacity of 250 tons per hour and the wet plant or gravel and sand section, 400 tons per hour. Surge pile, live-storage capacity will be in the 15,000-ton range.

An older plant operated about three miles west of the new plant, has excavated shallow gravel over a wide area. Frank D. Marks and Sons, Tracy, Calif., have a sand and gravel plant a short distance from the Pacific Coast Aggregates plant. All this area required a large amount of stripping. Water was also a problem during dry months. At the new location farther out on the flats, the Pacific Coast Aggregates Co. has a square mile of excellent gravel bearing ground. One would not expect any gravel in the vicinity, but the company sunk about 18 pits with draglines and clamshell rigs to 65- and 75-ft. depth. By this method and others they have developed good gravel to a total depth of 100-ft., and no stripping worth mentioning is required. Slightly below this depth water was encountered. A well drilled down to the 500 ft. horizon has easily produced 2000 g.p.m. during the dry season. The gravel and sand, which has been tested by many different organizations, including the U. S. Bureau of Reclamation, has passed all the tests required.

To supplement the older plant, a temporary sand and gravel plant has been built and placed into operation alongside the plant now being constructed. It has a capacity of 200 t.p.h. At this temporary plant, a new 30-ton Plymouth, standard gauge switch engine was placed in service. It has a V-8, LeRoi Engine.

A rotary combination screen and scrubber will be used in the preliminary operation and Dorr classifiers will make the initial sand separation. Two Symons cone crushers, a 3-ft. and 4-ft., and a Gates 5K will do the secondary crushing. A 10- x 36-in. Farrel-Bacon jaw crusher will do the primary crushing. Gravel in the area is not large, the deposit running about 36 per cent sand with 32 per cent plus 1¼-in. There is very little pea gravel as tests show this to be about 0.06 per cent of the total. "It is a gravel man's dream," says E. E. Williams, general superintendent for Pacific Coast Aggregates Co. The new plant is served by the Tesla branch of the Western Pacific. The nearest station is Carbona and the plant will be known as the Carbona Plant.

The Central Valley Project will supply water for irrigating vast areas in the San Joaquin valley, and the Lower Sacramento Valley district will soon construct one of the large canals



Modern sand and gravel plant of Fontana Gravel Co., Fontana, Calif. Two conveyors are for stockpiling concrete and plaster sand

through the edge of the property. The company has granted them a 500-ft. right of way through its holdings. Possibly a suitable tunnel will pass under this canal so pit conveyors can recover materials from the small fractional area cut off by this canal. It is also a possible source of water should additional water be required.

In the wet section, the finished sand and rock will go to 14 steel, cylindrical bunkers that have a capacity of 250 tons each. The screens (all Tyrock) will be on top of these bunkers. A reclaiming belt will be provided to return any unwanted oversize back to the crushing section. These bins, supplied by the Western Pipe and Steel Co., will be used for car loading primarily. For truck loading there will be eight additional cylindrical steel bins that have a total capacity of 400 tons.

The company has installed a Noble batching plant with a capacity of 100 t.p.h. The plant will eventually serve truck mixers but at present is being used mostly for construction work. A 150-t.p.h. "hot plant" also is to be built here.

Another large producer in this area is the Radum plant of Henry J. Kaiser, located a short distance from the Elliot plant of Pacific Coast Aggregates Co. An interesting feature of the Radum plant to the Eastern visitors will be the wide use of belt conveyors for bringing the pit gravel to the washing plant. This company pioneered this development and now is taking a new step that relates to this system; the fabrication, in its own shops, of all the troughing rolls used on several miles of field conveyors. These carrier rolls are made up of heavy 5-in. diameter pipe giving a much heavier roll. They are all provided with Timken bearings and the shafts are bored for grease injection. The Radum plant produces about 2,000,000 tons of aggregate annually.

In reclaiming the pit material at this large plant, two benches are used. The upper bench has a 3-cu. yd. Bucyrus-Erie dragline on crawler treads, and the lower bench has a newer 10-cu. yd. Bucyrus-Monighan walking dragline. The upper dragline loads to a "pendulum" conveyor that can be swung at any desired angle to the longer off-bearing belt. It is moved with power units. But in the lower bench, where the dragline digs below water, a new floating pendulum is now being tried out. As the receiving hopper end of this conveyor floats on pontoons, it can be moved considerably easier than the first conveyor. The hopper on the present pendulum is made of wood but a steel hopper is now being built.

Like other operations in this vicinity, this company is short on concrete sand and long on plus ⅜-in. pea gravel; long to the extent of about 3,000,000 tons to date which is now stockpiled near the plant. A small installation was started about mid-December to process this pea gravel for sand. Pea gravel is crushed in a 4½-ft., short-head, Symons cone crusher that is set to 5/16-in. discharge. It operates in closed-circuit with a 5- x 12-ft. Symons single-deck vibrating screen with 0.17-in. openings. Undersize passes to a duplex Dorr bowl classifier with a 13-ft. diameter bowl and two 4-ft. rakes. Sufficient water is added at the screen discharge to maintain proper density in the classifier for settling.

To crush the pea gravel to this fineness without choking the cone crusher, the pea gravel is first dried in a 3- x 16-ft. rotary dryer. The dryer uses two Cook burners both connected to the same low pressure blower. Gravel comes out of the dryer with a little moisture in it, but the rock is hot enough so that by the time it gets to the crusher over the belt conveyor system it is dry enough to crush without trouble. A heavy circulating load of material is returned from the vibrating screen, probably about 400 per cent. The crusher, with this load, is over fed but this condition is said to give more fines and greater capac-

ity. The unit is crushing 25 t.p.h. to the above fineness. About 20 gal. of oil per hour is used in the dryer.

In addition to this small unit, a much larger crusher installation will be in operation by the time this is in print. This unit will use an 8- x 12-ft. Marcy end-discharge rod mill to crush the pea gravel. This mill will receive undried rock from a reclaiming belt operating in a steel tunnel (corrugated iron culvert) and deliver it to the Marcy mill. The mill has a bell type feeder and will handle 65 to 75 t.p.h., according to estimates. It will carry a load of about 18,500 lb. of 3½-in. rod (50 rods), and will be driven by a 350 hp. synchronous motor. The rod mill will discharge direct to the Dorr classifier with no intermediate screens between. This will mean that the operators expect no oversize to come out of the rod mill. The rod mill will operate in conjunction with the present cone crusher setup. The latter will deliver the coarse portion of the concrete sand and the rod mill the finer. State specifications allow 0.0 to 3.0 per cent minus 200-mesh, and 2 to 8 per cent minus 100-mesh. The present unit is meeting these specifications and the rod mill is expected to do likewise. The writer, in his experience as an engineering consultant, has had considerable experience with rod mill grinding and feels that this installation is probably the best method, and cheapest, for producing crushed sand and that this unit will grind more tonnage than the operators expect and give a much better product.

A belt conveyor will take the sand from the classifier discharge and deliver it to a steel hopper. Railroad rails will go under the hopper so that gondolas or trucks can be loaded.

Crushed sand is not so good for plaster sand but is quite satisfactory for concrete work. However, plaster sand in this area is not a problem for there are several pits around the Bay area that produce only this commodity. The pits are operated by the several producers in the area.

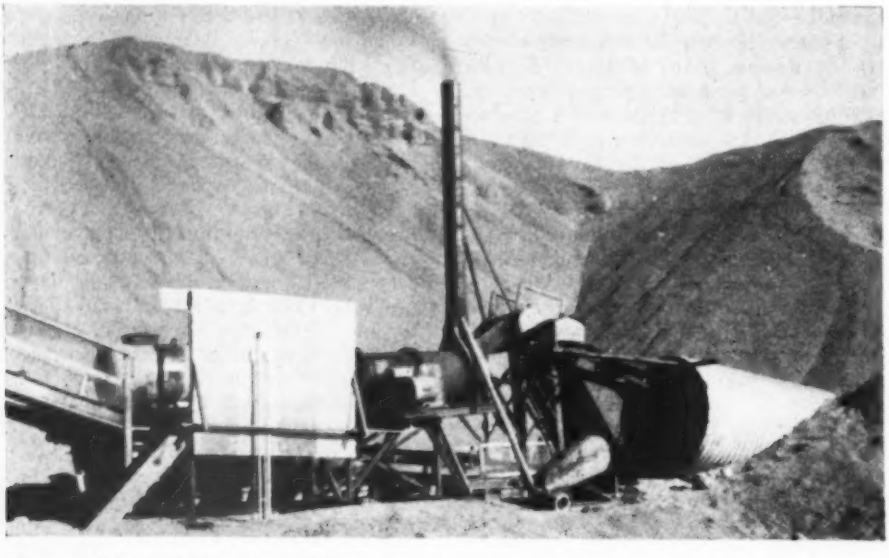
R. S. Barneyback is in charge of sand and gravel sales for the Henry J. Kaiser Co. Bart Carter is general superintendent and Charles Jones, plant superintendent, of the Radum plant. Henry J. Kaiser has other extensive holdings in the rock products field, including his Permanente cement plant with branches at Redwood City, Honolulu, and Seattle; and also the management of the Standard Gypsum Co. at Long Beach, Calif., where a modern wallboard plant is being installed. Other holdings are at Antioch, Upton, and Oroville, Calif. He has basic brick facilities at Moss Landing, and dolomite and lime at Natividad, Calif. The Glacial Gravel Co. of Seattle is now a part of his empire.

A third producer in this area is the California Rock and Gravel Co. This company is one of the older producers in the Pleasanton, Calif., district, and was the first in the district to put in grinding equipment for the production of concrete sand, or rather to bring up the production of this sand for some pit concrete sand is obtained. The ratio of pit sand (concrete) production to that consumed is about 38 to 50 so the difference must be met by grinding. To get the needed added amount, the company some six years ago installed a 30-in. Symons Impact mill, that operates in closed-circuit with a vibrating screen. It is fed pea sized gravel (minus 10-mesh, plus ⅜ in.) and delivers about 25 t.p.h. of crushed sand. This is a hammer type mill, and a welder is not only the plant's operator but also spends considerable time rebuilding breaker plates and hammers. The plates last about 5 hours when they are turned over and run an additional five hours. Then the worn parts are replaced with the rebuilt items. "It takes a lot of welding rod," says T. S. Silver, the plant superintendent, "but it pays us in the long run and we get rid of our excess pea gravel besides." The operation was described in ROCK PRODUCTS previously, but since that description the company has changed from pit conveyors to Euclid's, including two, 20-ton pay load, bottom-dump trucks of this type. Another installation is a 3-cu. yd. Bucyrus-Monighan walking dragline with a 90-ft. boom. The dragline loads a field hopper that serves the Euclid trucks. The field hopper is provided with Syntron vibrators as the muck is wet and somewhat sticky. A 78-in. Western Machinery Co. spiral classifier receives all the minus 1¼-in. material from the scalping-scrubbing rotary screen. This new classifier removes the clay and excess fines from the feed and helps prepare the material for the final screening and washing operations that follow. The machine is fed up to 200 to 225 t.p.h. of which 25 to 50 t.p.h. is overflowed and sent to waste. The balance is the sand and minus 1¼-in product. It joins the crushed material from the No. 13 McCully crusher and goes to the screening section of the plant. The off-bearing belt that receives this material is a ribbed-American Rubber Co. belt. It operates on a steep grade, and being wet was difficult to control at times but with this type of belt no trouble is encountered with spill-back and a neater operation results. In addition to the changes made, new square steel bunkers have been put under the screening section replacing the old wooden bins. This work was done by Western Knapp Engineering Co., a unit of Western Machinery Co. The changeover was made without stopping operations.

The company is planning to make some major changes in the crushing end of the plant, and will possibly install two screens in that department.

Most of the shipments are by rail and the company uses a Whitcomb locomotive for plant switching. The plant has a capacity of 225 t.p.h. Frank W. Erlin is executive vice-president and general manager.

Those members who are driving to the West Coast can easily visit the new and interesting plant of the Kern Rock Co., Dan Sill, owner, at Bakersfield.



Dryer used in the Radum plant of Henry J. Kaiser Co., to dry pea gravel ahead of cone crusher. In the background is a stockpile of 3,000,000 tons of pea gravel

Convention Tour Plants

The plants in the Los Angeles area are concentrated in two areas, the larger and more productive of these being what is referred to as the San Gabriel-Azusa district. This area is about half way between Los Angeles and San Bernardino and can be reached via Foothill Boulevard. The district produces about 650,000 tons per month out of a total monthly consumption of slightly over 1,000,000 tons of sand and gravel for the Los Angeles district. In this district the

Consolidated Rock Products Co. has three plants, the Sierra, the Largo, and the better known and largest, Irvingdale plant. Also here are plants operated by Graham Bros., Blue Diamond Co., Pacific Rock and Gravel Co., Arrow Rock and Gravel Co., the Owl Rock Co. and the Azusa Rock and Sand Co. The latter company has a new and ultra-modern plant near Azusa.

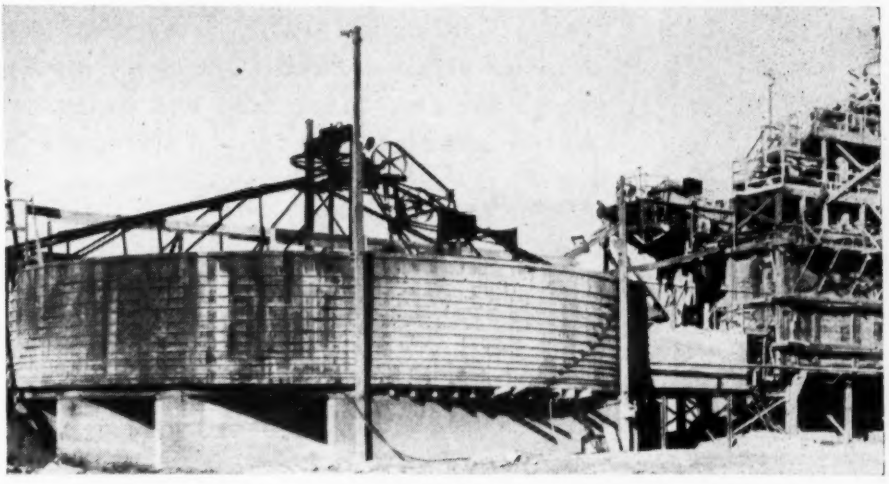
The Irvingdale plant of the Consolidated Rock Products Co., is on the agenda of plants to be inspected on the day set aside for Los Angeles plant inspection. While the plant has been in operation about 20 years, it has been modernized by changes when required. Visitors will be somewhat amazed at the depth of this large pit where at a single slice a 155-ft. bank is maintained. There is more gravel below this depth but water levels are at this horizon. Field conveyors and intermediate surge pile features this plant's preliminary operations. The pit run averages 30 per cent sand and 70 per cent gravel and the crushed gravel circuit is kept separate from the washed gravel unit. About 90 per cent of the processed material is shipped by rail to the company's service yards located in and around Los Angeles. F. M. Carroll is plant manager.

A second plant to be visited by the convention's guided tour will be that of Graham Bros. near El Monte. At El Monte is a batching plant, a hot plant, and headquarters for its fleet of trucks. The main offices are also located here. This plant, with a capacity of 600 t.p.h., is operating two eight-hour shifts for six days per week. Incidentally, this plant has been selected by the *Los Angeles Times* for a complete write-up in its special mid-winter edition.

This operation uses three Euclid 20-ton capacity Reo tractors, haulage units that are loaded by a Northwest 80 shovel. This loading and hauling combination permits a high pit production as the haul is short. The trucks discharge to a trap which acts as a surge pile, and if necessary that surge pile can deliver 12,000 to 15,000 tons of material to the washing plant. An interesting feature is the use of a shipyard gantry crane for handling sand over a reclaiming tunnel. Steel forms formerly used on the Metropolitan Water District's tunnel construction are used as forms for the tunnel.

In the plant all the plus 2½-in. gravel goes into the crushed gravel circuit, and the minus goes to the gravel circuit. Sand is washed out at a trommel screen over reciprocating rake sand washers. Concrete and plaster sands are made by changing screens in the screening section, and by regulation of depth of weir and speed of rakes at the sand classifier.

The plant produces the following products: plaster sand, minus ⅛-in.; concrete sand; No. 4 washed gravel, ⅜-in. to 3/16-in.; No. 3 standard washed gravel, 1-in. to ⅜-in.; No. 2 washed gravel, 1½-in. to 1-in.; No. 1 washed gravel, 2½-in. to 1½-in. From the dry section the following sizes are produced: stone dust; No. 4 crushed; No. 3 hot plant, ¾-in. to ⅜-in.; standard No. 3, 1-in. to ⅜-in.; No. 2 1½-in. to ¾-in., and railroad ballast.



Fourth Street Rock Co., San Bernardino, uses thickener to reclaim water for washing

Material is trucked to the Los Angeles area and to its Long Beach batching plant, and some shipments go out by rail via the Santa Fe. Paul C. Graham is president of the company, Russell C. Graham is vice-president; and L. I. Johnstone is vice-president in charge of production.

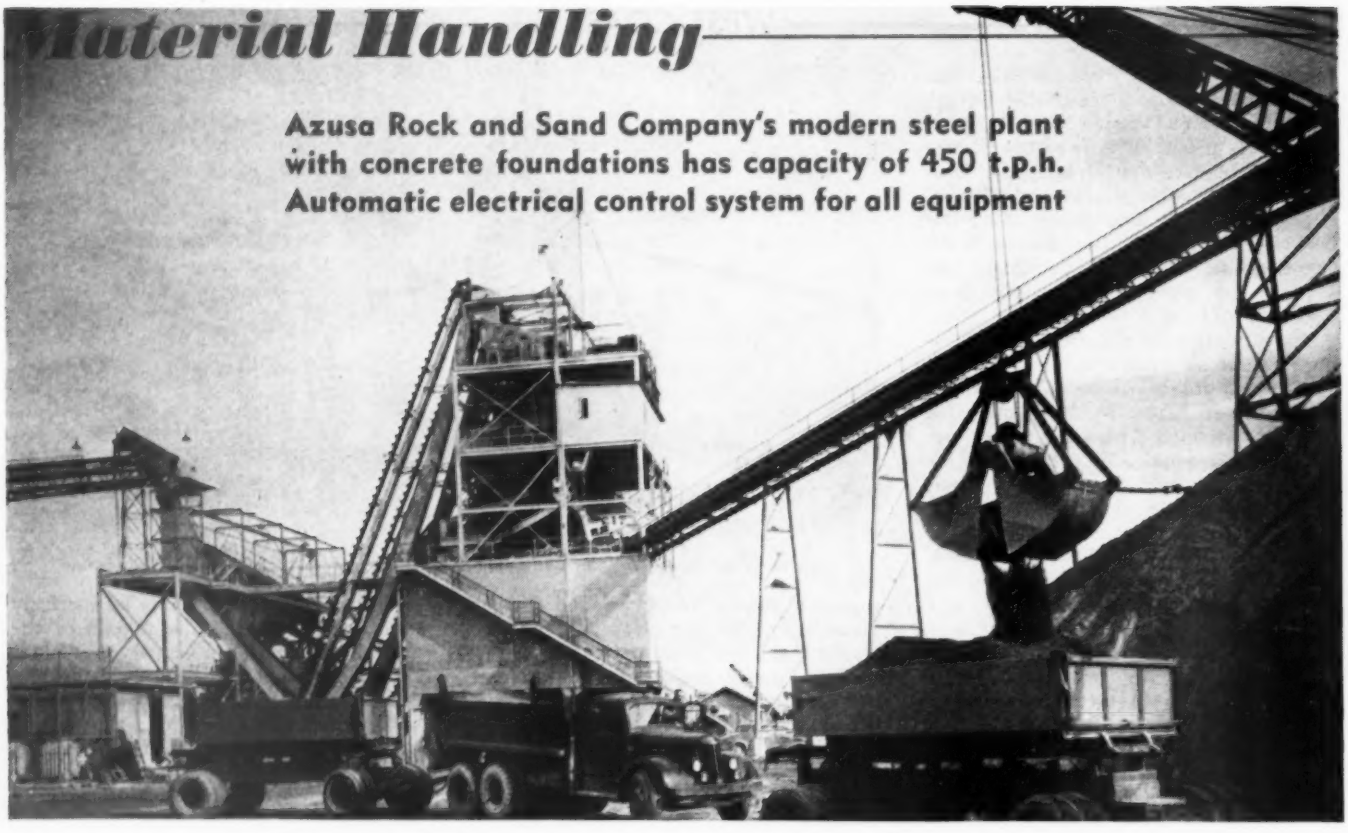
On the west side of Los Angeles, which is the other gravel production area, are four plants operated by the Consolidated Rock Products Co., the Blue Diamond Co., Arrow Rock and Gravel Co., and John D. Gregg. The first mentioned plant probably ranks the others in production and has been referred to many times in ROCK PRODUCTS. The area produces about 350,000 tons per month. Many of the visitors may also want to see Mr. Gregg's plant. This plant started off years ago with a capacity of about 30 t.p.h. but by adding to it from time to time, it has grown into a somewhat elaborate, but highly flexible plant. Just about any size product can be made here, either in crushed gravel or in washed, uncrushed gravel or blends of both. The plastering sand from this plant (as is the case with this district) is said to be more satisfactory than that from the Azusa plants.

Probably to the visitor, one of the interesting features is the use of a portable 28- x 36-in. Traylor jaw crusher mounted on a heavy steel frame that rides a short (also portable) rail section. To this crusher assembly is mounted a 48-in. belt conveyor, 100-ft. centers, which is swivelled to the crusher end. This conveyor can be swung around the crushing unit like the hands of a clock. A 1½-cu. yd. Lima shovel with a 40-ft. radius boom loads to a grizzly field hopper that is also a part of the swivel or pendulum conveyor. Under the field hopper is a reciprocating pan feeder. With this rig, a swath 280-ft. wide can be cut through the gravel bank. Thus with the 100-ft. bank that the pit maintains, the main field conveyors do not have to be moved very often. From the primary crusher, set to give not larger than 9-in. discharge, the crushed gravel is delivered to an 18,000-ton, live load surge pile by three belt conveyor units. The total capacity of the surge pile is about 35,000 tons. Incidentally, this company was the first to use a surge pile for intermediate storage in the Los Angeles district. These three belts total about 1700 ft. long and use B. F. Goodrich Co. belts that ride on Conveyor Co. idlers.

Under this surge pile is a reclaiming belt conveyor which is fed material by a Sterling Speed-Trol, remote-control, feed regulator. A new 36-in. conveyor belt, serving the plant, has Dodge-Timken roller bearings on its head, tail, and drive assembly and has a Dings magnetic head pulley for removal of tramp iron.

The conveyor discharges to a grizzly with 3-in. openings, the oversize going to an Allis-Chalmers 13-in. gyratory crusher, and its product becomes part of the crushed gravel circuit. An Allis-Chalmers rotary screen processes a dry concrete sand that is elevated to a battery of three parallel, shaft screens (4- x 12-ft.) where an unwashed concrete or an unwashed plaster sand can be produced. These fall to three circular steel silos. This interesting deviation from the usual practice is a new unit in the plant which was installed by the Conveyor Co. of Los Angeles. The rotary dry scalper also takes out a gravel cut (minus 1½-in.) that goes to the gravel screening section where there are three 4- x 8-ft. Conveyor Co., wet-operated, vibrating screens. The top screen has a double-deck with ¾-in. and 7/32-in. screen cloths, respectively.

(Continued on page 125)


Azusa Rock and Sand Company's modern steel plant
with concrete foundations has capacity of 450 t.p.h.
Automatic electrical control system for all equipment

Compactly arranged plant showing extensive use of belt buckets and chutes to conserve space

Compact Plant with Bucket Elevators

By WALTER B. LENHART

THOSE RESPONSIBLE for the program for the Los Angeles meetings of the National Sand and Gravel Association and the Ready Mixed Concrete Association (Hotel Biltmore, week of March 3) have set aside some of the conventions' time for plant inspection trips in the Los Angeles area. When we inquired of several producers as to which plants they would recommend for inspection, all included the new plant of the Azusa Rock and Sand Co. ROCK PRODUCTS joins in this recommendation as it is without question the outstanding sand and gravel plant to be built in the Los Angeles area for several years.

HARRY E. BENDER, president of the company, and the man who directed the design of this remarkable plant, extends through these columns a very cordial invitation to members of both Associations to visit his operations a few miles west from Azusa, Calif., in the San Gabriel valley section. To those who miss out on the Associations' guided tour of plant inspection and wish to see the plant, drive out Highway 66 from Los Angeles. Preferably, take the Arroya Seco Speedway to Pasadena. This 7½-mile stretch of ultra-modern highway will give the Easterner a preview of highways to come. If for no other reason, it is a pleasure to drive a speedway without a single business establishment or hot dog stand to mar or delay the trip.

There is no question but that a large number of similar highways will soon have to be built in the Los Angeles area, for it has the highest traffic density of any section in the world.

In preparedness for the vast construction program that must come soon and also to help take care of the great amount of home and industrial building, Mr. Bender placed his new plant in operation at a most favorable time.

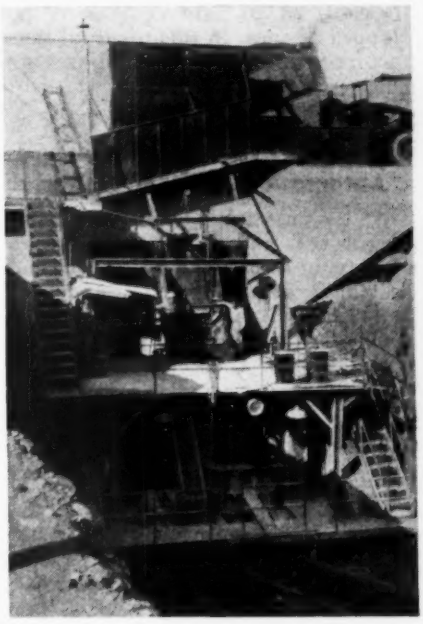
Hal McRoberts, plant superintendent

Azusa Rock and Sand Co. had an older plant at the present location, built in 1930, that was discarded entirely. In spite of shortages of steel and other materials, the plant was completed under company directives and placed into operation on schedule. All of the structures are of steel with heavy reinforced concrete foundations throughout. The plant has a rated capacity of 450 t.p.h. but has produced in considerable excess of that amount. The plant normally operates 12 hours per day for five days a week and eight hours on Saturday.

Mr. Bender wanted a plant that would do just exactly the things that his plant can do but, for the production he desired, he was faced with the decision of building one of two types of plants; a sprawling establishment that would be hard to supervise and which would require many operators, if he used a 100 per cent belt conveyor system of handling materials, or, a compact and easily supervised plant wherein bucket elevators would be used to more than average extent. The designers well knew the troubles that a bucket elevator can cause so, before adopting their use, a study was made of the weaknesses common to bucket elevators. When we say study, we

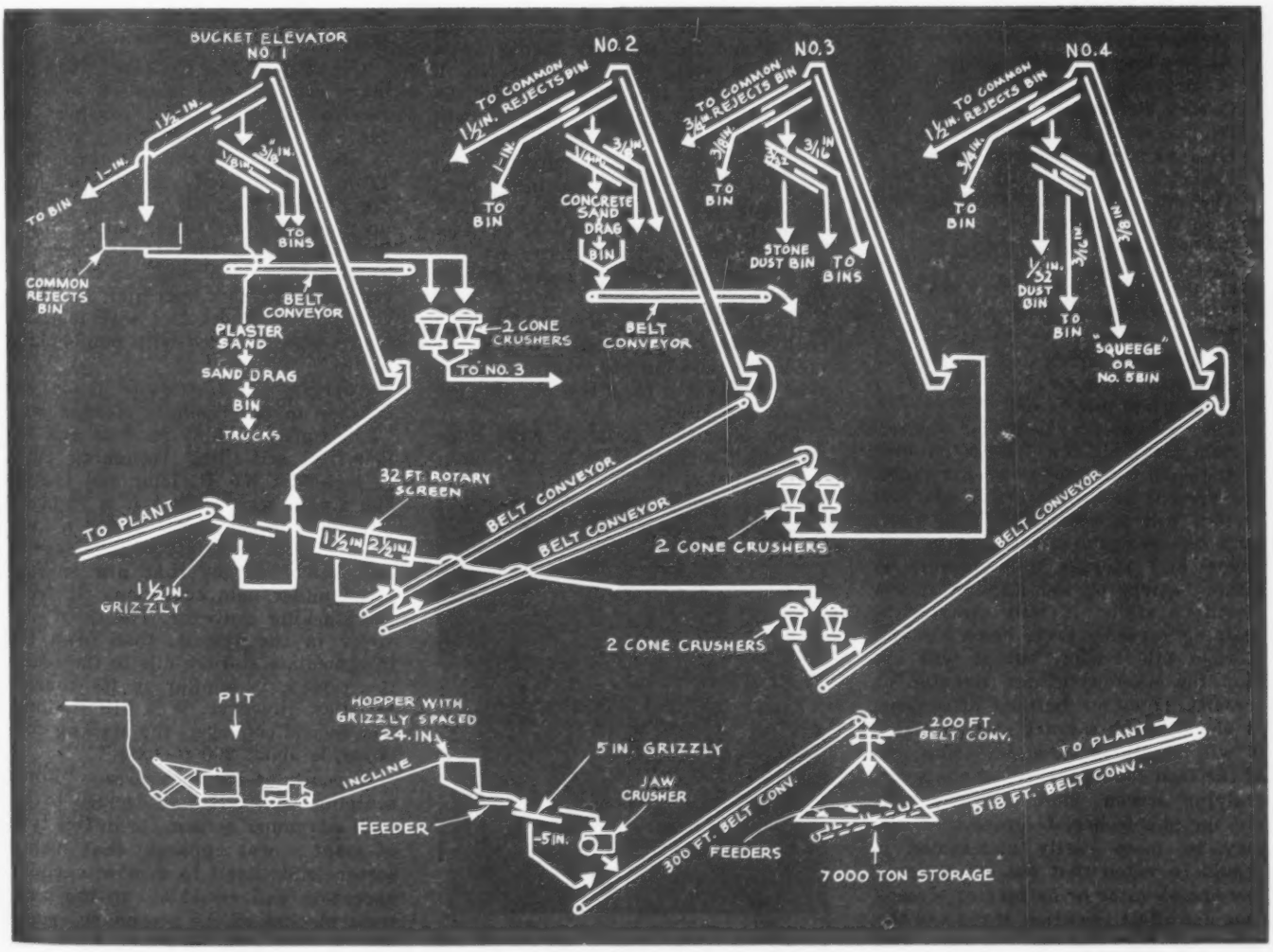
mean just that. Once these troubles were really understood, the designers proceeded to design a bucket elevator to eliminate the causes of trouble. Recently the plant operated 27 days continuously without a single shutdown except at the end of the 12-hr. day, so evidently the installation of bucket elevators has been amply justified. These elevators in the first place, do not operate from a pit. The tail pulley of each of four bucket elevators in the plant is about 3 ft. above normal ground level, and specially-designed trap-doors have been provided so that, in the event of a stick-up, these doors can be dropped instantly to free the buckets. Secondly, the lower portion of the elevator is enclosed with heavy mesh wire and steel plate so that it is impossible for anyone accidentally to allow any foreign material (like a piece of timber) to get into the system. The buckets are spaced from 15 to 18 in. apart, depending on the capacity required of each elevator. The buckets are also plenty large for the application and measure 18 x 8 x 8½ in. The head pulley is amply large to give plenty of traction surface and is not lagged. It is 42 in. in diameter and has a 22-in. face. The belts are all 20 in. wide and of 12-ply, American Rubber Co. neoprene rubber. Plenty of slope was provided for each elevator so that the buckets discharge properly and with practically no spill-back. The very little spill is caught in a steel pan that partially houses the return side of the belt, so that spillage returns to the elevator boot. The loading point of the buckets is high enough so that the bulk of the material gets into the buckets rather than into the boot. Each elevator has a center to center height of 76 ft. with the tail pulley being about 35 ft. off from vertical. The speed of each of the belts is 200 ft. per minute, which, along with this slope, gives a clean discharging bucket. The 12-ply belts are butt-joined, using Flexo belt lacing. The Chain Belt Co. supplied most of the assembly.

A second important feature of this plant is the electrical arrangement. A lot of time, study and thought went into the recommendations of Mr. Bender so that he would have a plant that would operate, from an electrical standpoint, with a minimum of trouble. It is obvious to anyone that in a plant having a more-or-less-compli-



Primary crusher station. Truck is dumping at upper level, feeder at second level, and crusher at third level with conveyor inclining up from the bottom

cated flowsheet, that the stoppage of a conveyor from a crusher (for instance) can really gum up the works



Flow sheet showing compact setup with four bucket elevators in plant with intermediate surge pile between pit and plant

if the feed to said crusher is not stopped at once. In this plant all these factors were studied out and an automatic stop and go system was built into the plant.

Wet and Dry Plant Units Have Automatic Electrical Controls

At the outset it must be first pointed out that the plant is designed to operate in two units which we shall designate as Unit No. 1 and Unit No. 2. Each unit is operated independently of the other.

Unit No. 1 (main processing) includes:

A—1 sand conveyor
B—1 sand washer
C—8 secondary screens
D—4 elevators
E—4 secondary crushers
F—2 small feed conveyors
G—1 rejects conveyor
H—1 scalping screen
I—1 main conveyor
J—1 feeder at intermediate storage pile

Unit No. 1 consists of two sections; a wet processing section and a dry processing section, each of which may or may not be operated independently of the other.

The starting sequence of the dry section of Unit No. 1 is as follows (the pump operates independently and is started first):

A—dry lower screens
B—dry upper screens
C—dry elevators
D—two small feed conveyors
E—four secondary crushers
F—reject conveyor

The starting sequence of the wet section is as follows:

A—sand conveyor
B—sand washer
C—lower wet screens
D—upper wet screens
E—wet elevators
F—scalping screen
G—main conveyor
H—storage pile feeder

The automatic electrical control system for Unit No. 1 is as follows: If the sand conveyor or washer stalls, the screens and elevators of the wet section will automatically stop along with the scalping screen, main conveyor and storage pile feeder. If either battery of wet screens or wet elevators stalls, it will control the scalping screens, main conveyor and storage pile feeder, but it will not stop the unaffected wet elevator or screens. If either battery of screens or elevators on the dry section stalls, it will result in automatic stoppage of the feed conveyors, reject conveyor, scalping screen, main conveyor and storage pile feeder. In order that this may be more easily understood it should be noted that the stoppage of any one elevator or battery of screens does not affect the other three and the only time that the two elevators and battery of screens are automatically stopped is in case the sand conveyor or washer should stall. If either one of the small feed conveyors stall, it will stop the scalping screen, main conveyor and storage pile feeder. If either crusher stalls, it will stop the scalping screen, main conveyor and storage pile feeder. If the scalping screen stalls, it will stop the main conveyor and storage pile feeder. If the main conveyor stalls, it will stop the storage pile feeder.

The secondary crushers are not included in the automatic control setup except that they cannot be started unless in the proper sequence but if any one of the secondary crushers stall it will stop the scalping screens, main conveyor and storage pile feeder. The crushers also can be started or stopped from the control room as well as from stations near the machines.

Unit No. 2 consists of two conveyors which are designated as Conveyor No. 2 and Conveyor No. 3, along with the primary jaw crusher and a grizzly feeder ahead of the crusher.

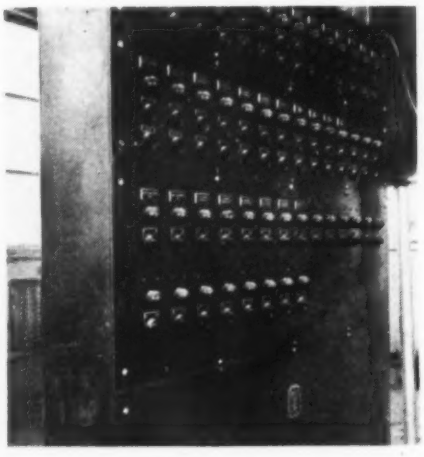
Unit No. 2 is controlled from a station near the jaw crusher and its various units are started in the following sequence:

A—conveyor No. 2
B—conveyor No. 3
C—jaw crusher
D—primary feeder

If Conveyor No. 2 stalls, Conveyor No. 3 and the primary feeder automatically stop. If Conveyor No. 3 stalls it will automatically stop the feeder. If the crusher stalls it will also automatically stop the feeder. The feeder is also automatically stopped when the material in the hopper goes down to a certain predetermined level. As in the case of the secondary crushers, the primary crusher is not automatically stopped at any time.

Local switches are also provided for each piece of equipment so that, if necessary, the machine can be turned over or operated for a few minutes for repair purposes.

The electrical controls were supplied by the Square D Co. Two main boards are provided, one for the plant and one for the pit. The connected load for the plant is about 1500 hp. Electricity is purchased.



Control switches for all equipment conveniently arranged in centrally located control room

Design Plant with Ample Machine Capacity

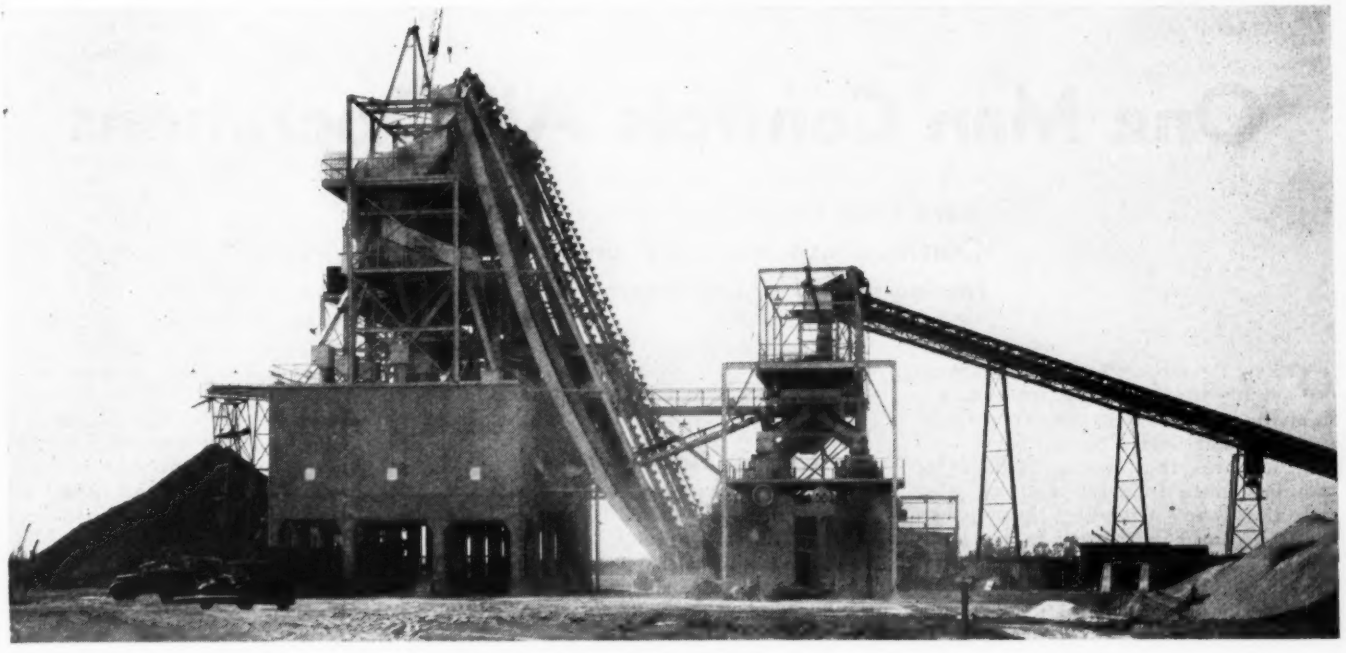
As an operating man designed this plant it is worth quoting in some detail many of the recommendations he made (with slight changes in nomenclature) and why he made them, so we here quote Mr. Bender's recommendations for each major unit, which, incidentally, were carried out to the letter:

Capacity of feeder at truck hopper: "In the original recommendations it was desired that this feeder be of the electro-magnetic vibrating type of sufficient capacity to handle comfortably 400 tons of pit run per hour. This feeder is installed ahead of the primary crushing unit and therefore should be at least 48 in. in width, 8 ft. long, with a grizzly at the discharge end for separating the fines from the coarse. All the material entering the truck hopper is passed over a grizzly set to size at 24 in. Thus it may be seen that the feeder will handle material from pit run to 24-in. boulders, and necessarily must be wide in order not to jam. Following the recommendations, a Jeffrey-Traylor feeder was installed."

Capacity of Jaw Crusher: "The primary crusher was installed so as to receive coarse material passing over the 5-in. spaced rail grizzly referred to above. It is of the jaw-type, 30 x 42-in. and is easily capable of handling 200 to 250 t.p.h. when set at 5-in. opening. As the fines (minus 5-in.) are removed before they reach the crusher, 200 t.p.h. will reach the jaw crusher. For this operation an Allis-Chalmers jaw crusher was installed and it was provided with non-choking plates."

Capacity of conveyor from jaw crusher to intermediate storage pile: "This conveyor is 36 in. wide and has long-life, self-oiling troughing rolls. It is about 300 ft. long and travels 300 f.p.m. which gives it a capacity of 400 t.p.h. and still leaves a very wide margin of safety to take care of any heavy surges that are encountered under field conditions. It feeds the stacking conveyor. The third conveyor in the system, that from the intermediate storage pile to the scalping screen, is similar in its characteristics. However, it is 518 ft. long. The second conveyor, the stackng conveyor, is about 200 ft. long."

Capacity of scalping screen: "For a scalping screen it was decided to install a trommel screen, for in this type of plant it was apparent that such a screen lends itself to a more variable operation and would aid in the strategic placing of the secondary crushers. A 7-ft. dia. by 32-ft. Link-Belt rotary screen was installed. This has



Overall view of plant showing how four cone crushers are conveniently mounted on concrete piers. Note ample headroom for trucks under concrete bins

a capacity of 500 t.p.h. It operates without an outer jacket although provisions have been made to install one easily, particularly for a distance of 15 ft. beginning at the feed end. This was desirable should we want to take off a special sand or rock at this point. Load on this screen is reduced by installing ahead of it a sloping 1½-in. grizzly that scalps out a large portion of this size material (minus 1½-in.)."

Capacity of secondary crushers: "Four Symons cone crushers have been installed which, for convenience, can be designated No. 1, 2, 3 and 4.

"Crusher No. 1 is a 4¼-ft. standard crusher which has a feed opening of 9½ in. and will receive rock safely up to 8½ in. in diameter. It has a capacity of 185 t.p.h. set at 1½-in. discharge. All material passing over and through the scalping screen is delivered to this crusher and its teammate (Crusher No. 4), however Crusher No. 4 is set to 1-in. discharge. All materials through these crushers pass to one of two horizontal 24-in. belt conveyors and are delivered to the bucket elevator en route to the crushed gravel screening section.

"Crusher No. 2 is a 4-ft. Symons short-head cone equipped with a coarse bowl and has a feed opening of 4 in. and a capacity of 125 t.p.h. when set at ¾-in. opening. The intermediate size rock from the scalping screen is fed to this machine, from which it is conveyed and elevated by a bucket elevator to either the coarse or fine screening section as desired."

"Crusher No. 3 is another 4-ft. cone crusher but equipped with a medium bowl, with a feed opening of 2⅞ in., and having a capacity of 125 t.p.h. when set to ½-in. The small rock and gravel from the scalping screen, along with the returns from both the fine and coarse screening section, go to this crusher via a common point assembly reject bin."

Capacity of conveyors from secondary crushers to elevators: "A 24-in. belt running 200 f.p.m. easily handles this product as it is all finely crushed and there is no lift involved."

Capacity of elevators: "Four elevators are required. On bucket spacings of 18 in., and running 200 f.p.m., these elevators will safely handle 100 t.p.h. on the gravel side. On the crushed rock side, closer spacing of buckets is necessary. We did consider speeding them up at first. This added capacity is necessary because of the circulating load on the crushed rock side due to the returns of oversize from the screening sections. Theoretically, the elevators have a capacity well above any production we contemplate and will take care of the varying field conditions."

Capacity of classifying screens: "We have installed eight Allis-Chalmers 4- x 14-ft. double-decked Ripl-Flo vibrating screens. Instead of placing the screens tandem which is a much simpler installation, we have placed them in batteries of two each, one placed underneath the other so there is in essence a change in the direction of flow of material from top screen to bottom screen. This system of installation permits taking off the coarser sizes first and thus eliminates delivering the entire feed load on the fine screen cloth as is the case in a tandem installation. It does require more head room. The capacity of these screens is 125 to 150 t.p.h. which allows about 20 per cent to 25 per cent tolerance to take care of the surges and circulating loads. Competent engineers have made the statement that our screening plant is as well engineered as any on the Pacific Coast."

Water volume needed for wet side of plant: "The water level in this country is high so a 1000 g.p.m. Pomona pump driven by a 125-hp. motor supplies sufficient water for our plant."

Miscellaneous items: "We have two sand washers with a capacity of about 50 per cent more than our older plant had. Each washer operates independently; that is to say, they have separate head shafts. This provides a means of operating one washer at a time if necessary. The reject conveyor from the reject bin is a 20-in. belt running 200 f.p.m. and easily handles this load."

Texrope drives are used on everything except the conveyors and sand washers. The bucket elevators are being changed over to Texrope drives. The Conveyors Nos. 1, 2 and 3 are driven by Master Electric Co. geared-in-head motors in conjunction with a double roller chain enclosed in metal housings. The conveyors were supplied by Barber-Greene Co. The drive on the stacker belt is through a set of extra drive pulleys (not at the head or tail pulleys). About 50 ft. from the tail assembly the other two conveyors are driven at the head end in the standard way. The return belts on all three main conveyors are protected by a tight-fitting, dome-shaped metal cover. All bearings in the plant, except on the rotary screen, are Dodge, Timken. U. S., Sterling, and Louis Allis motors are used throughout the plant.

Excavating Methods

The deposit under excavation at Azusa is about 115 ft. deep. The gravel deposit is uniform as to quality and stratification so that the pit can be operated by taking a 50- to 60-ft.

(Continued on page 128)

One Man Controls All Operations

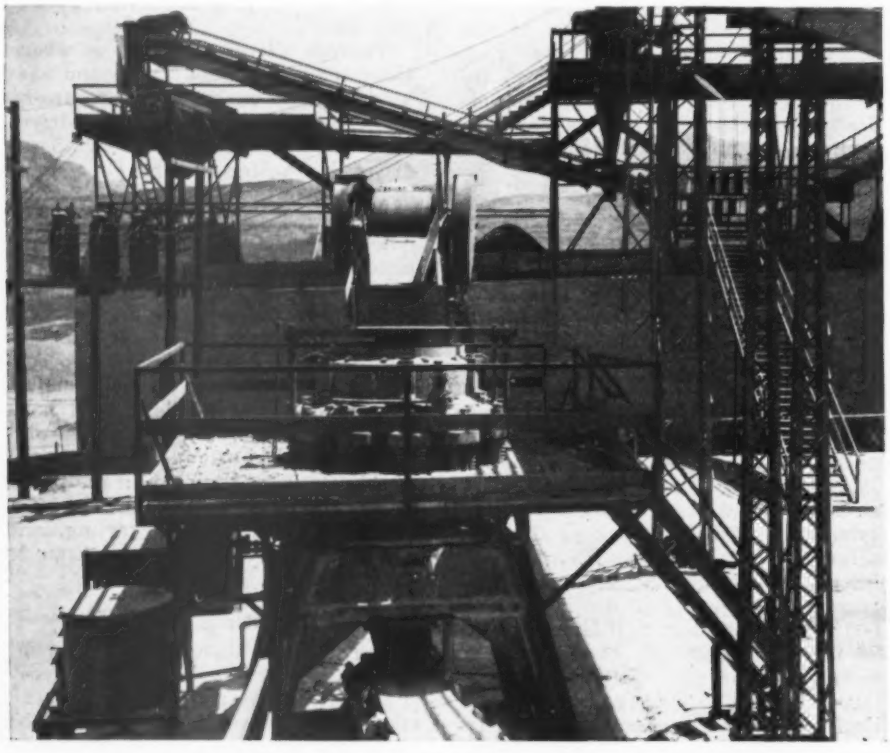
Kern Rock Co. has an unusual plant layout. Crushers are mounted on steel legs, allowing plenty of headroom for maintenance

ONE of the newest and most modern plants in California was placed in operation in 1946 by the Kern Rock Co., at Bakersfield. The plant has several features that are quite new to the aggregate industry and we are sure that many attending the conventions in March will want to see how Dan C. Sill, owner and designer of this novel plant, mounted Symons cone secondary crushers, as well as the primary 18-in. by 36-in. Farrel-Bacon jaw crusher on welded structural steel members rather than on the conventional concrete. To our knowledge, this is the first time this has been done. At his older plant, now dismantled, the crushers were on concrete foundations and the off-bearing conveyors ran between the concrete piers. The tail pulley was practically out of sight. With this new method of mounting the crushers, everything under the crusher is open to inspection. It is one of the many details that have been incorporated into the plant to make it a one-man-controlled plant; namely, that all the major pieces of equipment can be seen from one central point and that point is on the ground, not from any elevated platform.

Crusher Support Details

The two secondary cone crushers are mounted on 10- x 10-in. I-beam legs with welded joints, all work being done by plant forces. Flanges on these beams are about ⅝-in. thick. A 1¼-in. steel plate, welded to the bottom of each leg, is bolted to a flat concrete slab with 2-in. bolts, using a nut and jamb-nut. On the top of each post is a similar plate that bolts to the crusher assembly. On three sides, these posts are braced with a 6-in. double extra heavy pipe. This is a horizontal member and is about 22 in. from the top of each post. At the floor line, or just above it, is a second horizontal 4-in. dia. heavy pipe welded to each leg. A 6-in. dia. cross pipe completes each side. The front, through which the belt conveyor passes, has a horizontal 4-in. dia. pipe brace at the bottom. The top section comprises first, a ¾-in. steel plate extending across the top of the "A" frame, then a 6-in. dia. pipe and two plate angle braces. These are all welded to form a solid section at the top. This makes a solid and very rugged and practically vibrationless support. The plant has been in operation almost a year and no trouble has been experienced from this installation. The legs which are about 9 ft. high, are assembled so as to make a truncated pyramid with the inside top of the post about 18-in. from the inside of the toe, with an imaginary line connecting each of these points in the plan of the "A" frame.

The primary crusher is mounted somewhat different. It has I-beam legs of the same cross section as on the secondary crushers, but the posts are about 12 ft. high. These posts have an I-beam cap, about 20 ft. long, running the long axis of the crusher, making a span of about 12 ft. with a 4-ft. overhang at each end. The caps are joined at the extreme ends by cross members of similar steel. Legs are cross-braced with 6-in. pipe. The crusher frame rests on the longitudinal I-beams. Main dimensions are approximate.



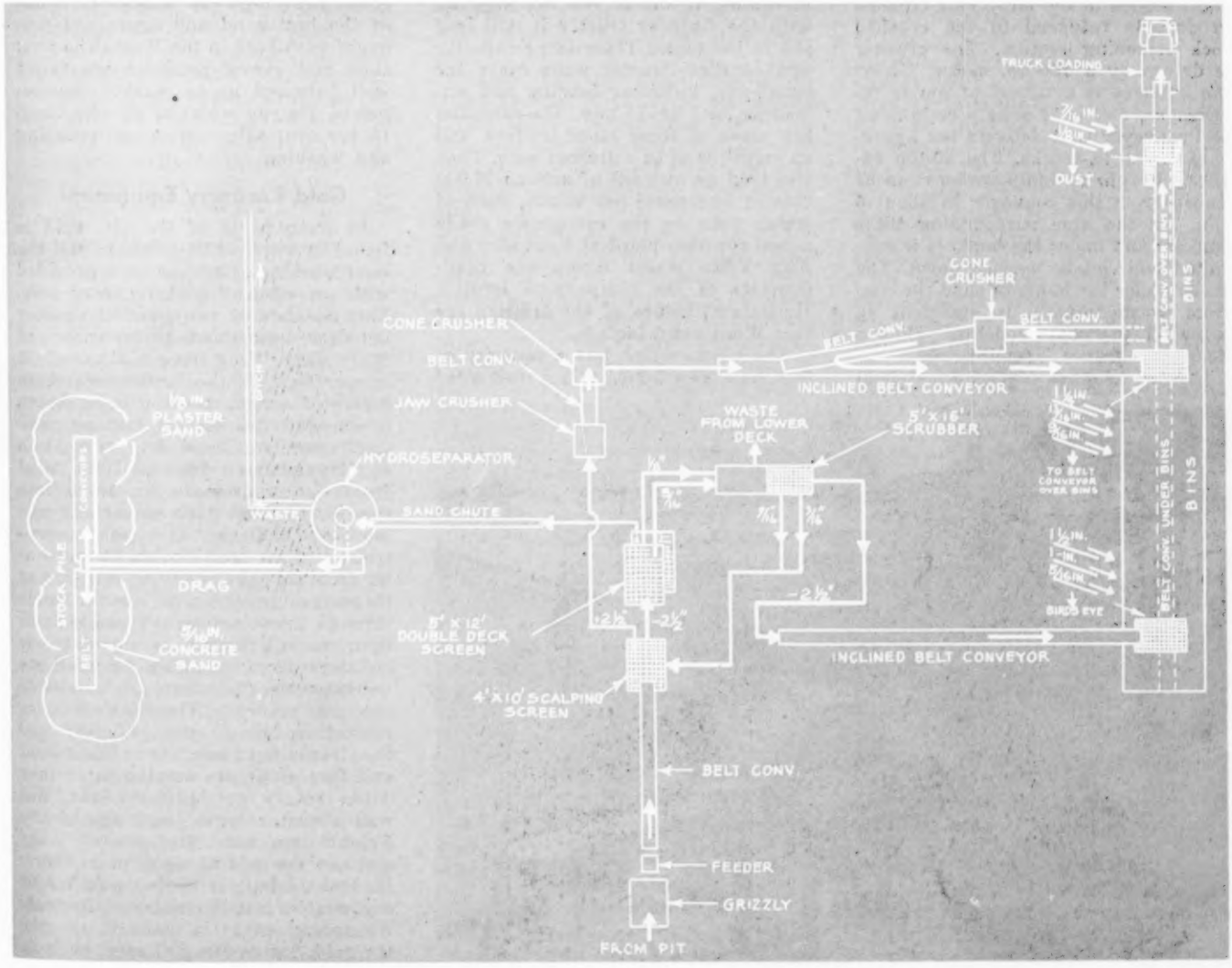
Close-up of cone crusher mounted on steel legs with belt conveyor placed between legs

Scrubbing and Screening

A second interesting feature is the method of scrubbing and preliminary screening. Minus 2½-in. material is sent through the rotary scrubber. On the discharge end of the scrubber is 8 ft. of 9/16-in. screen, and an outer jacket of 3/16-in. mesh. Here the products are separated and washed with high velocity water jets. Then the materials (except minus 3/16-in.) are recombined and go to the conveyor serving the gravel screening sections. At this point all gravel washing is completed, and at the final sizing screens no more water is added. Thus the material in the bunkers has only a little surface moisture in it. It makes for a more sightly floor in and around the bins.

Another interesting feature is the method of washing down under the main storage bins and adjacent territory. The eleven reinforced concrete storage bins, which are arranged in a single row, each have a capacity of 350 tons. On one side provisions are made for loading trucks direct by means of a chute. On the other side and the side nearer the plant a 24-in.

Birds-eye view of plant and storage facilities. Note classifier in center foreground with sand storage to the right and neat bin set up to the left. Flume in foreground carries away water in washing up plant floor



Flow sheet of crushing and screening operations; sand storage to the left, and finished gravel sizes to the right

Showing compact arrangement of crushers with relation to belt conveyors, allowing ample room for maintenance and cleaning up concrete floor below

belt conveyor parallels the bins, and any desired coarse oversize (or even intermediate sizes) can be sent to a 4-ft. short head, Symons cone crusher set to ¾-in. by another conveyor at right angles to the bins. This crushed product is returned to the crushed rock screening section. The crusher is driven by a 100-hp. motor. Under the bunkers is a tunnel of ample dimensions, and in it runs a reclaiming belt conveyor that delivers the aggregate direct to trucks. The 20-ton capacity Freuhauf dump trailers can be loaded from this conveyor in about 6 min. All the area surrounding these bunkers and under the bunkers is concreted and can be washed down. The grade under the bunkers (and the concrete waste flume) is sufficient to carry off the coarser debris. Thus a clean appearance is maintained.

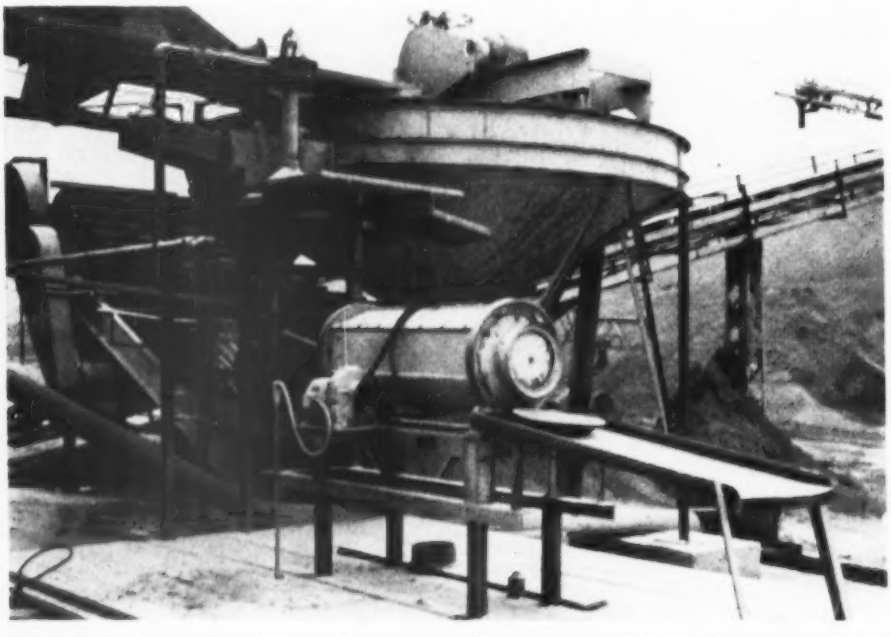
Located 12 miles east of Bakersfield on the Niles road, near the junction of Kern River and Cottonwood Creek, the plant may be reached from Los Angeles via Highway 99. If you see a Freuhauf semi-trailer headed east get in behind it, and if you can keep up with the Autocar tractor it will lead you to the plant. These large capacity semi - trailer - tractor units make the round rip, including loading and unloading, in 1 hr. 15 min. The company has seven of these large trailers, and an eighth is to be delivered soon. They will haul an average of around 26,000 tons of aggregate per month, most of which goes to the company's ready mixed concrete plant at Kentucky and Alta Vista street where the headquarters of the company is located. Hoists and bodies of the trailers are Gar Wood manufacture.

The plant, which has a capacity of 300 tons per hour, was constructed and plans drawn by the Stephens-Adamson Co. under the direction of Mr. Sill.

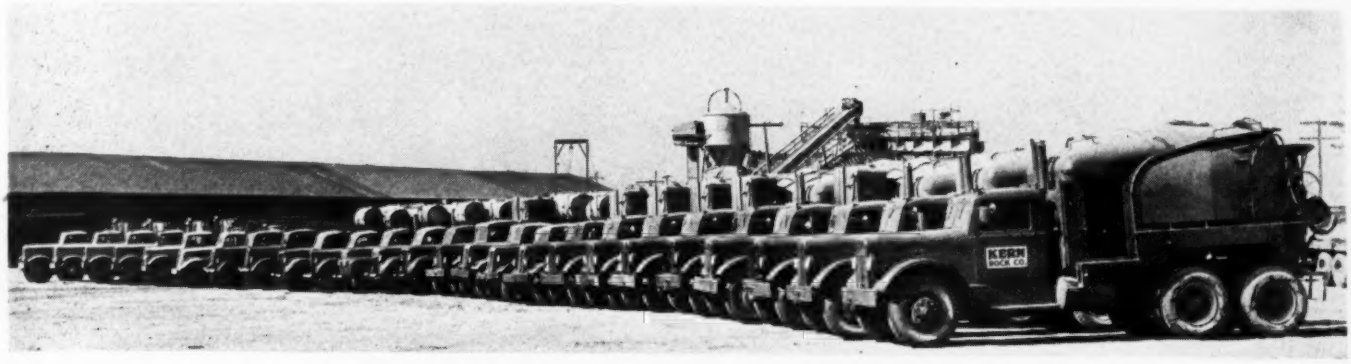
Located about 200 yards from the plant is the pit which supplies, according to highway engineers, some of the best sand and aggregate produced anywhere in the West. The final sand and gravel products are fairly well balanced as to market requirements. Pit run material shrinks about 15 per cent after screening, crushing and washing.

Gold Recovery Equipment

In some parts of the pit, gold is found in worthwhile amounts and the sand washing plant has been provided with an efficient gold recovery unit. This consists of two parallel shallow launders each about 30 in. wide and 25 ft. long. They have a slope of ⅞ in. per foot. In the bottom are three layers of screen, the top layer being ⅜ in. and the bottom two progressively smaller. These are referred to as "Hungarian" riffles. All the sand from the preliminary screening section is split and flows over these two launders and any free gold is entrained in the wire cloths. All the water from the sprays on the scalper and its succeeding screen carries the sands through these launders. There is more than enough water to prevent the launders from plugging up and yet not too much turbulence for a reasonable gold recovery. These launders are cleaned up about once per year and the cleanings (a mixture of black sand and free gold) are amalgamated in a Titan rotary amalgamater. Mr. Sill was a visitor some years ago at the Friant dam sand and gravel plant and saw the gold recovery plant there. He had the builder of that gold recovery section install similar equipment. No special effort is made to recover the gold, for as Mr. Sill says, he is in the rock business and doesn't want to be led astray by the intriguing nature



Hydroseparator for dewatering ahead of drag classifier. In foreground is gold amalgamator unit



Line-up of mixer truck fleet with concrete batching plant in background

of gold processing. However, the amount of gold recovered is expected to be in the $1500 per month range.

In this semi-arid section of the state, water is a hard-to-get commodity. The company uses in excess of 2000 g.p.m. which is pumped from the Kern river through a 12-in. spiral steel pipe that is about 1½ miles long. The lift is nominal. At the river is a 2-stage, 8-in. dia. discharge, Byron-Jackson centrifugal pump directly connected to a 200-hp. General Electric motor. The discharge line from the pump is 8 in., but a few feet from the pumphouse the line expands to 12 in. dia. In the 8-in. section is a check valve and a gate valve. Provisions are also made for by-passing water in the main line to the suction end of the pump for priming. Nearer the plant are also three Layne-Bowler deep-well pumps that can supply sufficient water during the wet seasons of the year.

Sand Recovery Methods

For the recovery of plaster and concrete sand, the two gold recovery flumes discharge to a 14-ft. Wemco hydroseparator that serves a 60-in. Stephens-Adamson sand drag. The drag discharges to a series of conveyors arranged in the form of a "T." The concrete sand falls to the main leg, and is discharged to a second conveyor that acts as a stacker. When plaster sand is made the other leg of the "T" stacks this sand. To change from one sand to the other (concrete to plaster) the 5/16-in. screen on the second wet screen is replaced with an ⅛-in. screen. The 5/16-in. screen is then moved up to the lower deck of the main gravel screening section and produces "Bird's eye" gravel. The sand washing and stacking equipment is all located so the single operator can keep his eyes on the work. His station is the main switch house where all electric starting switches are located.

A new 1½-cu. yd. Marion shovel is used in the pit for loading to three trucks. At the plant, the trucks dump to a hopper provided with a 16-in. heavy I-beam grizzly, and what few oversize builders remain are discarded. The pit hopper discharges to a 30-in. American Rubber Co. belt, 185 ft. centers, which is fed by a 42 in. by 6 ft. Stephens-Adamson reciprocating pan feeder. The inclined belt conveyor discharges to a 4- x 10-ft., single-deck Stephens-Adamson wet vibrating screen having 2½-in. square punched openings. Minus 2½-in. material falls to a 5- x 12-ft. Stephens-Adamson double-deck vibrating screen. The top deck has 9/16-in. cloth and the lower deck has ⅛-in. (for plaster sand). Throughs go to the sand washers as described above. The oversize from both screens passes to a 5- x 16-ft. scrubber. On the discharge end of the scrubber is about 8 ft. of 9/16-mesh screen and an outer jacket of 3/16-in. mesh.

Fines from the lower deck go to waste as most of the sand is removed at the scalper screen. The other two sizes join and go to the main conveyor belt serving the gravel section screens mounted on a deck over the concrete bins.

The scrubbing assembly is rather unusual for the products are first separated and then rejoined for final screening. This separation is designed to provide more efficient washing and, to keep water out of the main bunkers for the final screening, no water is used. The material in the bins below is therefore semi-dry.

The main conveyor serving the gravel section discharges to a 4- x 12-ft., triple-deck vibrating screen. The top deck is 1½-in., the middle deck in 1-in., and the lower deck is 5/16-in. mesh. All products fall to bins below.

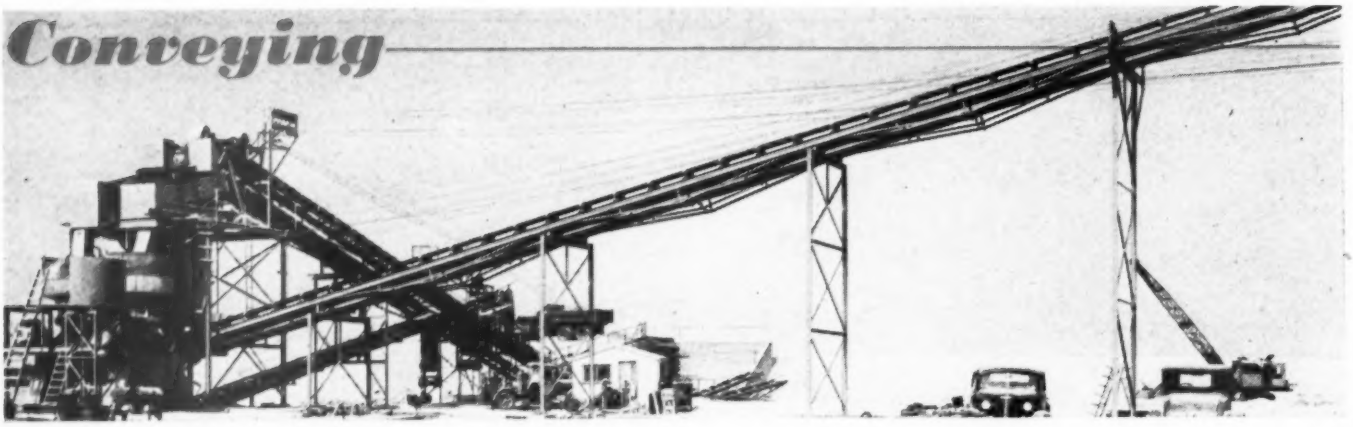
The plus 2½-in. from the scalping screen goes to the 18- x 36-in. Farrel-Bacon jaw crusher which is driven by a 150-hp. slip ring motor through V-belts. It discharges to a 30-in. belt conveyor, 50 ft. centers. Throughs from the scalper go to a 4½-ft. standard Symons cone crusher, provided with a medium bowl, which is set to 1¼-in. discharge. The Symons cone is driven by a 150-hp. motor through V-belt drives. Cone crusher throughs go to a second 185-ft. conveyor, paralleling the uncrushed gravel conveyor, which dumps to a 12-ft., triple-deck vibrating screen. The top deck is 1½-in., the middle deck is 13/16-in., and the bottom deck is 9/16-in. mesh. The throughs from the bottom deck fall to an inclined 24-in. belt conveyor, 50 ft. centers, and is delivered to a 5- x 12-ft. Stephens-Adamson, double-deck vibrating screen. The top deck has 7/16-in. cloth, and the other deck ⅛-in. All other products from the two screens, including the rock dust, fall to bins below. The screens on the crushed rock section operate dry. The plant has a connected load of 900 hp.

Concrete Batching Plant

At Kentucky and Alta Vista streets in Bakersfield, the company has a 4-cu. yd. batching plant for ready mixed concrete. A fleet of 20 Jaeger mixers mounted on Autocars serves probably as great an area as any similar plant in the United States. As Bakersfield is the hub of a sprawling oil field, trips of 75 miles are quite common. To make fast deliveries over this large area, much of which is over dirt roads, the trucks are equipped with Freuhauf third-axle attachments so that greater legal capacities can be hauled.

In the downtown office S. M. Bryson, assistant manager, has his headquarters with Claude Lime as office manager. Larry Rohlfing is plant superintendent. John Hayes is superintendent of the ready mixed concrete plant; Charles Pomroy is concrete engineer; and Edward E. Cummings is transportation and shop foreman.

Showing how primary jaw crusher is mounted on 60-in. steel I beams



Truck may be seen dumping to grizzly over primary crusher in background with conveyors inclining up to secondary screening and crushing station. Conveyor to the right takes material to screening plant and storage bins

Duplicate Conveyor System Promotes Efficiency

Triangle Rock and Gravel Co. has conveyor capacity to handle 600 t.p.h. Corrugated steel silos for storage

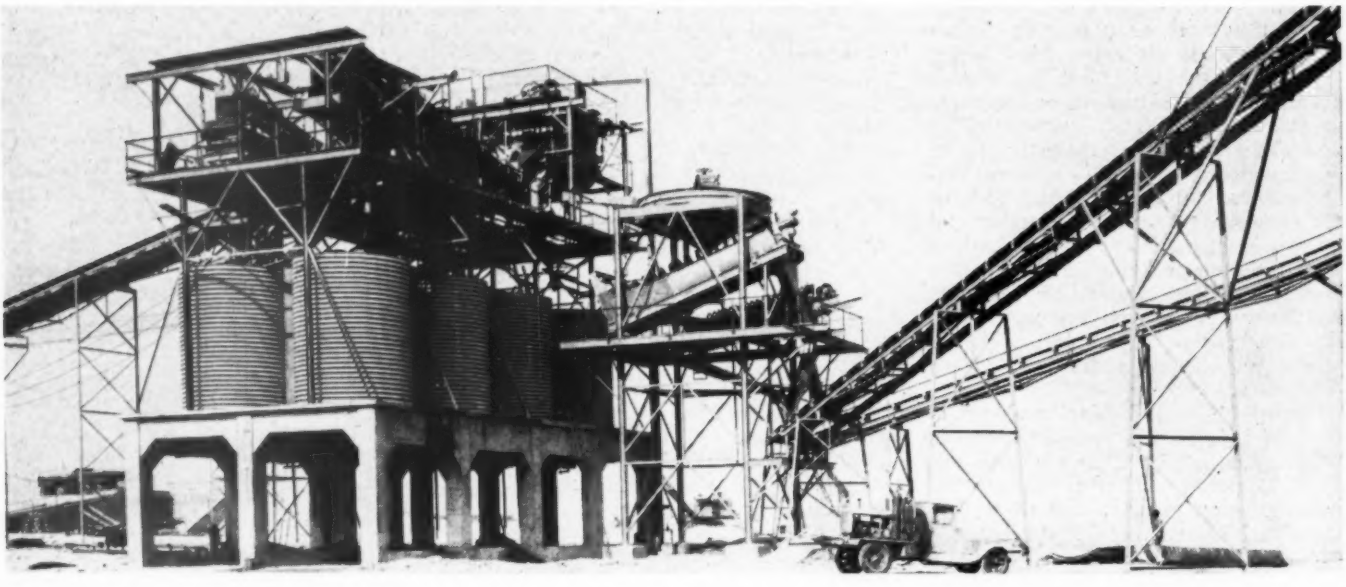
SOME DRASTIC CHANGES in the San Bernardino county sand and gravel industry were required with the completion of a federal flood control project. The flood waters were so diverted that two producers either had to build new plants or go out of business. The Lytle and Cajon Creeks project and the part producers played in its construction was described in ROCK PRODUCTS, December, 1945, p. 88.

Triangle Rock and Gravel Co., in this flood-control area, replaced its old plant with a new plant about ¼-mile from the former location. This new plant ranks along with the best both in appearance and in its ability to deliver large tonnages at low cost. Members of the National Sand and Gravel Association, when on the Pacific Coast should take time to see and to compare it with many other excellent new plants on the Coast.

Neat Spanish style office building of Triangle Rock and Sand Co.

To reach the plant from Los Angeles or Pasadena, drive out Foothill Boulevard to the edge of San Bernardino, staying on Highway 66 all the way. On arriving at the edge of that city the highway turns left on Mt. Vernon Avenue. Follow this avenue to Highland (a distance of about 12 blocks). Highland Avenue is reached just before the Santa Fe railroad tracks. Here turn sharp left again and drive about two miles when the plant can be easily seen from the highway.

This new plant was so laid out that its capacity could be easily increased if necessary, or if revisions in the specifications required new grades of material, the changes necessary could be easily made. The layout uses a duplicate system of belt conveyors arranged in the form of the letter "L." There is plenty of head room available for future additions and changes, and though the plant is only a few months old installations to increase its efficiency are already being made.



Final screening plant with unique corrugated steel storage bins below. To the right are the sand classifiers with two sand stacker belts radiating out, below

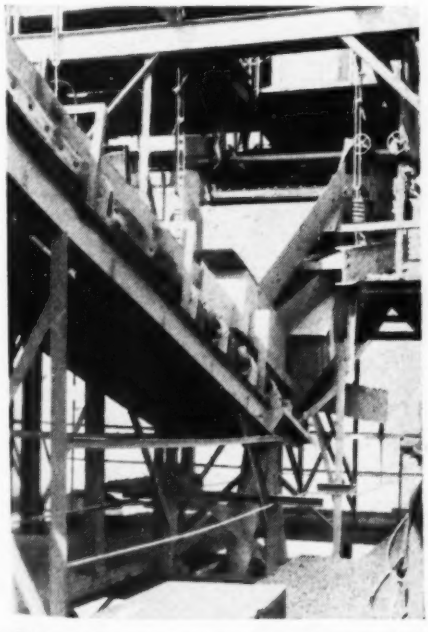
The plant is built of steel with substantial concrete foundations for the major units.

Present crushing capacity is in the 450 t.p.h. range. The conveying capacity is close to 600 t.p.h. While conveyor belts are only 24 in., it must be remembered that there are duplicate sets of conveyors operating in the 400 f.p.m. range. Decks supporting the vibrating screens are large and wide enough to hold larger screens should future conditions warrant it.

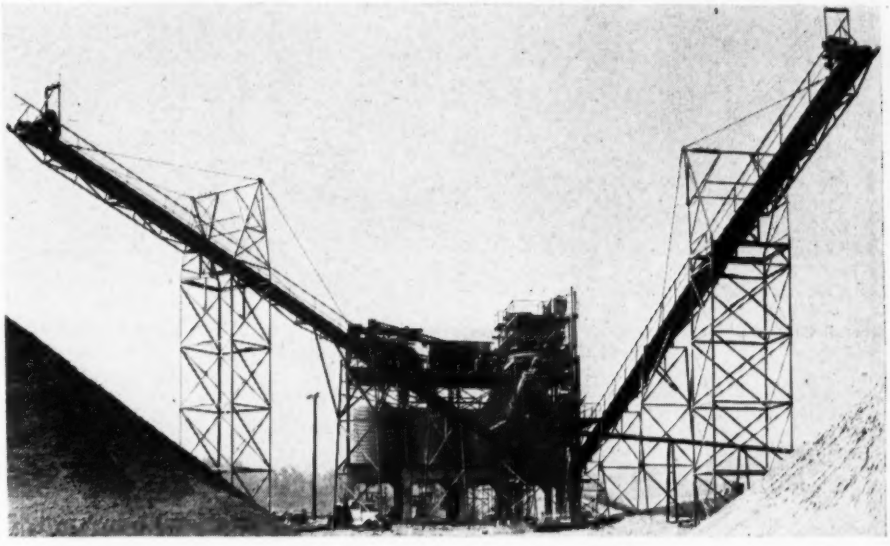
Crushing and screening circuits are so arranged that the washed sand and gravel can be kept entirely separate from the crushed gravel, or if desired, blends of the two can be made although little of the latter procedure is contemplated.

As customary with Pacific Coast plants, no housing is constructed over the equipment. This has the advantage that inspection is easy and the dust hazard, and dust accumulations in the plant, are hardly worth mentioning. The designers had an eye on the present high labor costs, and so designed the operation that a single operator can control the greater part of the plant. His post is the broad, roomy platform, well elevated and supporting the final vibrating screen assembly. From his post the operator can easily keep his eye on the Wemco hydroseparator that separates the sand for the two spiral classifiers, one an Akins and the other supplied by the Denver Equipment Co. All control switches for the conveyors and screens also are on this platform.

The eight cylindrical storage bins are rather unique as they are made of large diameter, 10-gauge multi-plate corrugated iron culvert material. These tanks are 16 ft. high and 12 ft. in diameter, and have a capacity of 60 tons each. Set apart from each other about 30 in., the interstices are so built up that additional storage space is available.



Triple-deck, wet screen for handling uncrushed gravel. Note method of suspending screen



Twin stacker conveyors for stockpiling sand. Two classifiers may be seen in background in front of main plant

Primary Crushing

The primary crushing plant is so laid out that pit material can be delivered by large capacity haulage units should future demands require it. At present three Diamond T, 12-ton capacity trucks are used to deliver pit material to the plant. Later it is planned to use Euclid-type haulage units for this work. With this in mind, the designers, the Stephens-Adamson Co., provided heavy 14-in. I-beams, spaced on 15-in. centers, for the grizzly over the crusher receiving hopper. This hopper is about 16 ft. square. There is very little plus 15-in. rock in the pit run and the few boulders encountered are thrown back into worked out portions of the area.

Ahead of the 18- x 36-in. Universal jaw crusher is a second 45-deg. sloping grizzly spaced on 5-in. centers to which material is fed by a 42-in. by 7-ft. reciprocating Stephens-Adamson pan feeder. The surface of the bars making up the grizzly are hard-surfaced for longer life. The purpose of this second grizzly is to make a preliminary separation of the straight uncrushed gravel (and sand) from the gravel that will be 100 per cent crushed material. Oversize from this grizzly falls to the jaw crusher and the undersize passes direct to the gravel conveyor circuit. A heavy vibrating screen may later replace the grizzly.

Screening and Secondary Crushing

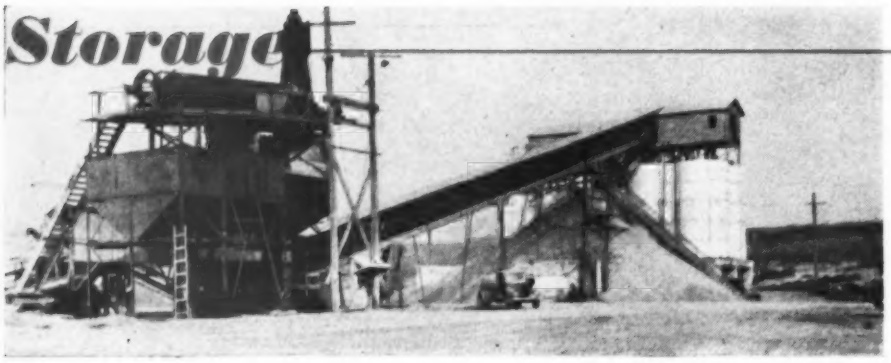
For a clear understanding of the plant layout, we will first follow through the minus 5-in. material that drops through the sloping grizzly. This material falls to a 24-in. inclined conveyor, about 200 ft. centers, which delivers it to a 4- x 10-ft. Stephens-Adamson single-deck vibrating screen with 2¾-in. mesh screen cloth. The plus material falls to a 3-ft. Traylor "Ty" crusher set to deliver a 1-in. discharge. This crusher discharges to a 24-in. inclined return belt that is a part of the crushed gravel circuit. None of this crushed gravel gets into the uncrushed gravel circuit.

Minus 2¾-in. material from the vibrating screen goes to another long conveyor belt which moves it to a triple-deck Simplicity vibrating screen that operates wet. This screen has a top deck of 7/16-in. mesh cloth, a middle deck of ¼-in., and a bottom deck of ⅛-in. Oversize from the top deck falls to a short 24-in. inclined belt that serves a double-deck 4- x 12-ft. Stephens-Adamson vibrator. Its top deck has 1¾-in. for the top mesh and ⅞-in. for the lower deck. It also operates wet. The various sizes produced from these two screens drop to the silos below.

Sand Recovery

Sand from the lower deck of the Simplicity screen flows to the 14-ft. Western Machinery Co. hydroseparator, which discharges to a 60-in. Akins spiral classifier supported over a 22-ft. tank. This spiral classifier discharges direct to either the concrete sand stacker belt or the plaster sand stacker belt. Only one kind of sand can be made at a time and a change of screen is necessary to make another type of sand. Overflow from the Akins screw flows to a 54-in. Denver Equipment Co. spiral classifier. This screw rests on a 15-ft. tank. The fine sand from this screw can be discharged to either the concrete or plaster sand stacker belts or split between both. There is only a very small tonnage of material produced by the second classifier (less than 25 tons per day) but it is sufficient to meet requirements for minus 100-mesh material.

(Continued on page 105)



Overall view of plant with primary crushing and screening station to the left and conveyor inclining up to final screening station and storage bins

Service Rock Co., Riverside, Calif., planning to build 1000-ton per 8-hr. day plant to take care of increasing demands for ready mixed concrete aggregates

Fifteen Precast Concrete Silos For Aggregates

TYPICAL of the many smaller sand and gravel operations on the Pacific Coast which are trying to gather together materials for a new and more efficient plant and at the same time bring up production of present plant facilities to satisfy heavy demands is the Service Rock Co., at Riverside, Calif.

A rather novel feature for so modest an operation will be the use of 15 precast concrete silos for storage of materials. To meet present heavy demands, the company installed a 2-ft. Symons short head cone crusher to supplement the 24- x 30-in. roller bearing jaw crusher used as the primary unit. Incidentally this plant was built in the mid 30's and was described by Nathan C. Rockwood in ROCK PRODUCTS, September, 1936, p. 88. Originally, the plant had a capacity of about 80 t.p.h. but by close supervision the production was stepped up to 135 t.p.h. The design was not changed much but Phil Larsen, plant superintendent, advises that the tonnage was increased by speeding up here and there, cutting out the bottleneck in the crushing circuit, and giving-the-gun to the various units until maximum capacity was assured.

Some stripping is done at the pit which is about 300 yd. from the plant. A small P&H shovel removes the 3 to 4-ft. of overburden which is all sold locally for garden fill and other domestic uses. A 1-cu. yd. Bucyrus-Erie with an International Diesel drive unit loads the pit sand and gravel to trucks for delivery to the plant. The bank of the pit is about 18 ft. high and has considerable fines.

Crushing and Screening

A considerable area surrounding the plant has been worked out. Pit material is put through a short rotary screen, the upper end of which has a ⅜-in. mesh cloth. Dry, unwashed fines, removed here fall to the boot of an open bucket elevator serving a rotary screen mounted over two steel bins. The short primary rotary screen only scalps out a portion of the fines but the second rotary screen rescreens the material, producing a concrete sand and a ⅜-in. "bird's eye" gravel. Scalping out a dry sand is common practice on the Pacific Coast, and is an easy method of maintaining a high percentage of fines in the concrete sand. The dust hazard does not seem to matter much as all the workings are out in the open.

The rotary screen producing the final sands here is driven by a United States geared-in-head induction motor. Inasmuch as there is no shock to the gear assembly in the motor, this type of drive seems to be ideal.

Oversize from the short rotary screen goes to the jaw crusher previously mentioned. The crusher discharges to a short, inclined belt conveyor that carries all the material direct to the Symons cone crusher for reduction to 1⅛- to ¾-in. depending on the material desired. The cone crusher discharges back to the main 24-in. belt conveyor serving the rotary screen.

Minus material from the short rotary screen falls to a long belt conveyor which delivers the material to the main washing and screening section mounted over 10 concrete silos. A Symons vibrating screen removes the ¾-in. and the 1½-in. materials which fall to the silos below, as do the minus ¼-in., plus ¾-in. gravel. The minus ¼-in. sands are split between two drag sand classifiers. These Esperenza-type machines run faster than is standard practice, being in the 120 to 150 f.p.m. range. This speed gives greater turbulence than is standard and as a result only the coarser sands settle out here. The first drag classifier discharges to the second producing a finished sand. The coarse product of the first drag is again split, part going to a small wet vibrating screen where any stray oversize is removed and the split fraction joins the throughs and falls to storage below.

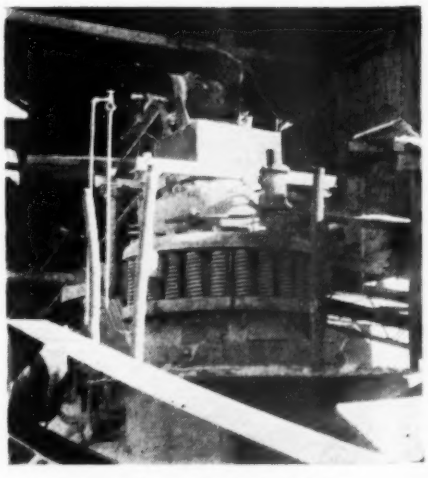
All wash waters flow to a worked out pit where the solids settle out. Periodically these pits are allowed to drain and dry out and the settled sands are gathered with a dozer equipped crawler tread tractor and the material sold as "Silt Sand." This fine sand finds favor with the concrete block and concrete shingle trade as it makes a more waterproof product and improves the appearance with a smoother finish. The company also processes engine sand in addition to the concrete and plastering sand.

Use Silt Sand for Ready Mix

At its ready-mixed concrete plant, Concrete Rock and Sand Co., an affiliated company, the fine "silt sand" is added to each batch of "regular" concrete at the rate of 250-lb. per yard of concrete.

Besides the concrete storage silos referred to, considerable ground storage space is used with the materials being reclaimed by one of two P&H shovels and/or clamshell rig. The latter uses a McCaffrey clamshell bucket.

The plant serves the rich orange growing district of Riverside, Calif. About half of the company's sales are



Small cone crusher installation

to small unit buyers, home builders, etc., and the balance of its sales are to contractors of not too large projects. To take care of this extensive orchard district, the company has a nice fleet of 13 trucks formerly in army service. These trucks were equipped with special dump bodies and the main chassis frame has been strengthened to carry the usual 15-ton load. Strengthening of the frame is accomplished by welding a ⅜- x 6-in. steel plate to the top of the channel iron that comprises the main frame section. It is welded vertically so that this frame becomes roughly 12-in. high. The company found that the trucks would not stand up without this reinforcement.

Stewart Adler and Perry Hayden are the owners of the Service Rock and Sand Co., with Jere Bowden as manager. Cliff Gray is in charge of the office and one of the few employees who has been with the company through practically its entire life.

New Triangle Rock Plant

(Continued from page 103)

Returning to the 5-in. grizzly at the primary crusher, the oversize after passing through the primary crusher falls to a parallel 24-in. conveyor belt that delivers the material to a 4- x 10-ft. Stephens-Adamson vibrating screen. It operates dry like its companion screen on the uncrushed gravel circuit. It has a 1½-in. mesh cloth, the oversize falling to a second 3-ft. Traylor "TY" gyratory. Throughs go to the previously mentioned return belt that discharges back to the main belt serving the crushed gravel circuit. The throughs from the vibrating screen fall to a parallel, inclined 24-in. belt conveyor which discharges the material to a 4- x 10-ft. Telsmith triple-deck vibrating screen that operates dry. This screen has a top deck of ¾-in. mesh, a middle deck of ¼-in., and a lower deck of ½-in. The oversize from the top deck goes to another short inclined 18-in. belt that delivers to a 4- x 10-ft. Symons vibrating screen. At the time of inspection this screen was not in use and the plus ¾-in., minus 1½-in. crushed rock was falling direct to bins below. It can, however, be used when different screening requirements are necessary. The lower deck of the Telsmith screen produces rock dust which drops to bins below.

The primary crusher is driven by a 75-hp. motor through Gates Vulco drive "C" belts. The two Traylor crushers also have 75-hp. motors with similar drives. The four larger belt conveyors each have 30-hp. motors, and are driven through five Vulco "B" belts.

Plans are now being made to scalp out a dry concrete sand at the secondary crushing and screening assembly. As head room has been allowed for it, a take-off belt will be provided to take the minus ¼-in. dry sand and deliver it to a steel storage bin. Dry material will be ground stored from that hopper by trucks. Some sort of covering will also be provided for the longer belt conveyors to protect them from winds. All the main belts have a 3½-ft. rise in 12 ft. Most of the 900 g.p.m. of wash water is now purchased but later it is planned to reclaim a large part from settling ponds.

Pit material is excavated from a 25-ft. bank by a Link-Belt dragline. An Osgood dragline with a McCaffery clamshell is used for stockpiling purposes. At present material is being hauled about 150 yards. An Allis-Chalmers tractor and an International tractor are used extensively around the plant and pit. The International pulls a LeTourneau scraper loader, and the Allis-Chalmers tractor is equipped with a bulldozer.

The two sand stackers, previously referred to, are being arranged so that a reclaiming belt will run under each pile. The tunnel housing this belt will be of 12-gauge, 10-ft. diameter, corrugated iron culvert material similar to the silos.

The owners of the Triangle Rock and Gravel Co. are N. O. Baker and James Mitchell. Mr. Baker acts as general manager. Clare Layton is superintendent and was in charge of construction. Homer S. Herrick of Stephens-Adamson designed the plant.

Pacific Northwest Building Plants

A VISIT to the Pacific Northwest area finds many evidences of booming business and an increased tempo of activity among rock products producers. However, they have been confronted with many problems.

In the Seattle area ready mixed concrete producers were allowed a $1 increase last June, the first and only increase granted by O.P.A. during its life. Portland cement recently took a 20¢ per bbl. increase so that concrete prices are again being upped to offset this increase. Sand and gravel prices have also gone up 15¢.

The city is well supplied with ready mixed concrete plants strategically spaced so that concrete is sold at a unit price with no consideration being taken for distance of haul or location of point of use.

Aggregate producers, including the Pioneer Sand and Gravel Co. and Glacier Sand and Gravel Co. (now owned and operated by Henry J. Kaiser interests), the Klinker Sand and Gravel Co. and others have large fleets of trucks. The first mentioned company is rehabilitating its North Lake Union mixing plant. This unit was inactive during the war.

The Permanente Co. has started using its new storage silos located on E. Marginal Way just across the waterway from the Klinker Sand and Gravel Co. operations. Cement will be water-borne to the storage silos. The installation, in essence, gives the Seattle area its fifth cement plant. The Glacier Sand and Gravel Co. has unloading and storage facilities for aggregates at this location as well as batching units.

Big Washington Road Program

Plans have just been announced by the Washington State Highway Department for construction of a four-lane "super-highway" to connect Portland, Ore., with Seattle. The new highway will eliminate many curves, by-pass practically all cities, even Olympia, the capital, and will just touch the edge of the city of Tacoma, Wash. It will reduce the distance from 188 to 160 miles. This highway, which will cost around $39,000,000, is a part of a 12-year construction program involving an expenditure of $130,000,000. About 53 per cent of the funds for this work will be from federal road grants.

Of the total distance involved, 152 miles will be "controlled-access" and will be completely free of cross roads and side roads with access to the highway by "clover-leafs." Near the Seattle end 10.8 miles will be completely inaccessible for its entire length except for clover-leafs at each end. The free-way as well as all the controlled-access section will be free from all businesses fronting the highway. A parallel road connecting with the clover-leafs is to be provided on which will be located inns or service stations.

In the program is the construction of a 2-mile tunnel through Snoqualmie pass. This will cost an additional $40,000,000 but will not come out of highway funds. It will be financed by revenue bonds to be paid off by a 50¢ toll charge.

Other highway construction will straighten virtually every primary highway in the state and provide for many secondary roads. Thus this most northwesterly state will continue for many years to have a backlog of business for the rock products industries.

While the cement plants have been busy and operating to capacity there is not the extreme shortage that has been so evident in the adjoining state of Oregon.

Labor is restless but there have been no strikes or are any threatened.

Oregon Developments

As yet Oregon has not announced any comprehensive road programs for 1947 or beyond, as have its Northern and Southern neighbors. However, maintenance work and some new road construction along with community

(Continued on page 126)

The Closed-Shop Issue

By NATHAN C. ROCKWOOD

BEFORE the passage of the National Labor Relations Act and the establishment of the National Labor Relations Board to administer it, in 1935, numerous employers preferred to make closed-shop union contracts, even if only for selfish reasons. For one thing, it often eliminated friction and strife within their own organizations, for in shops part union and part open there was often subtle, if not obvious, annoyance of non-union employees, which certainly did not help production efficiency. Since the N.L.R.A. and its rather biased administration by the Board, the picture has changed and the "maintenance of membership" and/or "closed shop" issue has become the cause of many employers' headaches.

Act Not Specific

The N.L.R.A. itself makes only one reference to closed-shop contracts: "It shall be an unfair labor practice for an Employer: Section 8. Rights of Employees (3) By discrimination in regard to hire or tenure of employment or any term or condition of employment to encourage or discourage membership in any labor organization; provided, that nothing in this Act, or in the National Industrial Recovery Act, as amended from time to time, or in any code or agreement approved or prescribed thereunder, or in any other statute of the United States, shall preclude an Employer from making an agreement with a labor organization (not established, maintained, or assisted by any action defined in this Act as an unfair labor practice) to require as a condition of employment membership therein, if such labor organization is representative of the Employees as provided in Section 9 (a) in the appropriate collective bargaining unit covered by such an agreement when made."

An ordinary layman would probably interpret this as a prohibition against the employer's use of coercion or otherwise assisting a union to get unwilling members, just as much as it is a prohibition against the employer's use of similar methods to keep his employees out of a union. However, the reference to closed-shop contracts has been held by the Board and by some of the courts practically to permit employers to coerce their employees into union membership by contract, closed shop or maintenance of union, with or without check-off of union dues.

Firing at Union's Request?

What happens then to the employer who signs a closed-shop contract which contains a proviso that he will fire any employee who is not in good standing with the union? The legal theory is that the union, being a private organization or club, has the sole right to judge a member's, or an applicant's fitness for membership, as well as to set the amount of dues and initiation fees. Consequently, a union may drop a member for its own reasons, and then demand that the employer fire him, under the closed-shop contract.

Do the N.L.R.B. and the courts uphold the employer in keeping the terms of his contract? Unfortunately there has been no regular or well defined policy. The Board has vacillated first one way and then another. But now that Wisconsin and other States have adopted legislation limiting or prohibiting closed-shop contracts, the Board and the courts are taking a somewhat different attitude, and are finding in specific instances that the employer who fires an employee for loss of union membership is guilty of an unfair labor practice, and subject to the penalties, which include reinstatement of the employee with full back pay.

State Laws Conflict

Wisconsin has an Employment Peace Act which makes an employer guilty of an unfair labor practice if he discharges an employee for failure to join a union, if the closed-shop union contract was not authorized by a secret vote of three-fourths of the employees. Now the N.L.R.A. provides for "Representatives designated or selected for the purposes of collective bargaining by the majority of Employees in a unit appropriate for such purposes." The Act left to the N.L.R.B. the definition of "the majority of employees," and the method of handling the elections. The Board decided to accept a majority of qualified votes cast, in place of "the majority of employees." Thus many unions have been chosen to pick bargaining representatives, who actually represent only a minority of employees. Apathy, indifference or actual hostility to the union keeps many from casting ballots. Hence, the Wisconsin law requiring a three-fourths affirmative vote of all employees.

The distinction is important and was the reason given by the Wisconsin Supreme Court in a decision against a paper company which had discharged a non-union employee on demand of an A. F. of L. union in compliance with a closed-shop contract. The company defended itself on the ground that the union had been certified by the N.L.R.B. after an election held under its auspices, and consequently that the State Employment Relations Board had no jurisdiction. The State Board had ordered the employee reinstated with back pay because three-fourths of the employees had not authorized the contract. The Wisconsin Supreme Court sustains its State Board's decision, holding that the United States Supreme Court has not attempted as yet to construe Section 8 (3) of the N.L.R.A., which we have quoted above. The Wisconsin Supreme Court did, in this decision, construe that section as merely an effort on the part of the Congress that enacted the law "to remove any possible restriction in the federal law on the right of employers and employees to bargain for a closed shop" . . .

The Court quotes from a Senate Committee report at the time the law was being debated: "The reason for the insertion (of the closed-shop proviso) was because by some interpretations of Section 7 (a) . . . assuring the freedom of employees to organize and bargain collectively, etc. . . . was deemed to illegalize the closed shop. The committee feels that this was not the intent of Congress when it wrote Section 7 (a); that it is not the intent of Congress today; and that it is not desirable to interfere in this drastic way with the laws of the several states on this subject. But to prevent a similar misconception of this bill, the proviso in question states that nothing in this bill, or in any other law of the United States, or in any code or agreement or approved or prescribed thereunder, shall be held to prevent the making of closed-shop agreements. . . . In other words, the bill does nothing to facilitate closed-shop agreements or make them legal in any state where they may be illegal; it does not interfere with the status quo on this debatable subject, but leaves the way open to such agreements as might now be legally consumated with two exceptions: The assertion that the Bill favors closed shop is particularly misleading in view of the fact that the proviso in two respects actually narrows the now existent law regarding closed-shop agreements. . . . Secondly, the bill is extremely careful to forestall the making of closed-shop agreements with organizations that have been established, maintained or assisted by any action defined in the bill as an unfair labor practice."

The Wisconsin Supreme Court has thus attempted to do what as yet the United States Supreme Court has not —that is, to interpret the N.L.R.A. reference to closed-shop agreements in the light of what was in the minds of the legislators who enacted the law. This interpretation is considerably different from those made for the past 10 years by the N.L.R.B. The Wisconsin decision, however, raises the question of conflict between state and federal laws, which eventually will have to be settled either through a revision of the Act by Congress, or a decision of the U. S. Supreme Court. At the November elections (1946) North Dakota adopted by referendum an amendment to its Constitutional Bill of Rights reading: "The right of per-

(Continued on page 122)

The Problem of Proportioning Portland Cement Raw Mixtures

Part II — Mathematical Study of the Problem

By L. A. DAHL*

THE CARBONATE CONTENT of the raw mix is expressed on a raw, or unignited, basis, while the potential composition is expressed on an ignited basis. As the carbonate content is adjusted by changing the proportions of limestone and shale, the ignition loss also changes. It is evident, then, that the relation between the carbonate content of a raw mix and its potential composition is not linear. However, within the narrow range of compositions involved in preliminary raw mixtures, the relation is so nearly linear that the effect of changes in carbonate content on potential composition can be expressed in very simple terms. This is also true of the relation between the percentage of limestone or shale and the potential composition.

Because of the practically linear relations involved, it is possible to start with a single limestone and shale, and a single mixture of them, and then study the effect of changes in proportions of the materials upon the carbonate content and upon the potential composition. Upon learning these effects we can devise a method of estimating the carbonate requirement.

For our purpose we can start with limestone *A*, shale, and raw mix No. 1, which were used previously in illustrating the function of control tests in proportioning raw mixtures. To demonstrate the effect of increasing the carbonate content 1.00 per cent; that is, from 77.24 to 78.24 per cent, we have calculated another mixture, No. 1A, which is shown with mix No. 1 in the following table:

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	RAW MATERIALS		MIXTURES		
	Limestone *A*	Shale	Mix 1	Mix 1*A*	Difference
Proportions of Raw Materials					
Limestone *A*			83.00	84.17	+1.17
Shale			17.00	15.83	—1.17
Oxide Composition (Unignited)					
SiO_2	3.57	63.24	13.71	13.02	
Al_2O_3	1.53	15.78	3.95	3.79	
Fe_2O_3	1.64	5.32	2.27	2.22	
CaO	49.71	2.12	41.62	42.18	
MgO	1.20	1.12	1.19	1.19	
Loss	42.35	12.42	37.26	37.61	
Carbonates	91.70	6.56	77.24	78.24	+1.00
Potential Composition*					
C_3S			56.45	70.67	+14.22
C_2S			20.07	6.53	—13.54
C_3A			10.57	10.06	—0.51
C_4AF			11.02	10.83	—0.19
MgO			1.90	1.91	+0.01

*Calculated by equations 1-4 from oxide analysis, ignited basis.

Referring to the table, it is seen that an increase of 1.00 per cent in carbonate content increases the C_3S 14.22 per cent and lowers the C_2S 13.54 per cent. This refers to the particular raw materials used in making mixtures 1 and 1A, but it is typical of the results obtained in such computations with a wide variety of raw materials. In general, the increase in C_3S for a 1.00 per cent increase in carbonate content is approximately 14.5 per cent, and the decrease in C_2S about 13.5 per cent. Conversely, to obtain an increase of 1.0 per cent in potential C_3S, the carbonate content should be increased 1/14.5, or 0.07 per cent. To obtain an increase of 1.0 per cent in C_2S, the carbonate content should be decreased 1/13.5, or 0.074 per cent.

Calculation of the Carbonate Requirement

Since the change in carbonate content required to secure a 1.0 per cent increase in C_3S or C_2S is known, it is possible to calculate the carbonate requirement from the potential C_3S or C_2S content of a raw mix sample,* and its carbonate content. For example, let us suppose that a sample of mix No. 1 has been analyzed for determination of the carbonate requirement, with the results shown in the foregoing table. The carbonate content and potential C_3S are 77.24 and 56.45 per cent, respectively. If the C_3S sought in the control operation is 60.0 per cent, the C_3S content of the sample is 3.55 per cent too low. The carbonate requirement is then 77.24 + 0.07 × 3.55, or 77.49 per cent. The same result would be obtained if mix No. 1A, made from the same raw materials, had been sampled and analyzed for determination of the carbonate requirement. It should be observed that in sampling for determination of the carbonate requirement, all that is necessary is that the sample is composed of the raw materials in use at the time. It does not need to be a correctly proportioned mix. It is important to understand this, because it may sometimes be possible to secure early information concerning the carbonate requirement by taking grab samples for the purpose instead of samples collected by a continuous sampler for routine control of proportions.

The method of calculating the carbonate requirement may be expressed in equation form, as follows:

For control of potential C_3S:

$$P = p + 0.07(A - a) \qquad (5)$$

For control of potential C_2S:

$$P = p + 0.074(b - B) \qquad (6)$$

in which P = carbonate requirement
p = carbonate content of mix sample (as determined by rapid control method)
A = desired potential C_3S
a = potential C_3S in mix sample
B = desired potential C_2S
b = potential C_2S in mix sample

It should be observed that in determining the carbonate requirement the carbonate content of the mix should be obtained by the rapid control method. The carbonate requirement is then in the same terms, automatically compensating for the effect of constant errors in the control test. For example, it will compensate for the presence of insoluble CaO and MgO in the raw materials in use at the time.

Influence of Coal Ash and Stack Losses

As the raw mix passes through the kiln some of it is picked up by the kiln gases and is carried out through the stack. This introduces a change in composition, because the fine par-

*The potential C_3S or C_2S is calculated from a complete analysis of the raw mix. The sample must be prepared for analysis by treatment which will make it possible to decompose the sample in acid. The preparation of raw mix samples is discussed in Appendix A.

ticles caught up by the gases flowing through the kiln are not of the same composition as the raw mix as a whole. In addition, when coal is used as fuel, the coal ash is deposited to some extent with the raw mix in the kiln and is brought forward to the burning zone with the raw mix, where it becomes a part of the clinker produced. As a result of the combined effect of coal ash and dust loss, or dust loss alone when gas or oil is used, the potential composition of the clinker is not identical with that of the raw mix fed to the kiln. The C_3S or C_2S sought in the mix should therefore be somewhat different from the value desired in the clinker. To determine what this difference should be, the potential compositions of the kiln feed and clinker may be compared during a period of typical operation. At one plant, for example, the C_3S sought in the mix is 13 per cent higher than the value desired in the clinker, while at another plant it is 6 per cent higher. In determining the carbonate requirement, the desired potential C_3S or C_2S used in the calculation should be the value sought in the mix, not the value sought in the clinker.

Influence of Changes in Limestone Composition

A detailed study of the influence of changes in composition of the raw materials is not needed, since control of raw mix composition by adjusting the holding point to correspond with the carbonate requirement takes care of the effects of changes in the raw materials. However, a brief study of the influence of changes in limestone composition will serve to demonstrate the need for such a system of control. It will also provide examples comparing the calculated carbonate requirement with the carbonate content of mixtures calculated from the limestone and shale compositions to obtain a desired C_3S content.

Tables 1 and 2 have been prepared for the purpose of comparing compositions of raw mixtures obtained from shale and various limestones, each a modification of limestone *A*. In Table 1, these raw mixtures are made to a constant carbonate content, and in Table 2 to a constant potential C_3S content. The raw material compositions in Table 2 are identical with those in corresponding columns of Table 1, and are repeated for convenience in considering raw mix compositions with reference to the limestone used. The tables are presented together to facilitate comparison of control based upon carbonate content with control based upon securing a constant potential C_3S.

The modifications in limestone *A* to obtain the remaining limestones in Tables 1 and 2 are as follows: In limestone B, $CaCO_3$ has been replaced by $MgCO_3$ to an extent sufficient to lower the CaO content 1.00 per cent. This results in a slightly higher ignition loss in limestone *B*. Limestone *C* is identical with limestone *A* on an ignited basis, but has a higher ignition loss. The compositions of limestones *D* and *E* require no comment.

In Table 1 each limestone has been combined with the shale to obtain a mixture with 77.24 per cent carbonates, the carbonate content of mix No. 1. In Table 2 each limestone has been combined with the shale to obtain a mixture with 56.45 per cent C_3S, the potential C_3S content of mix No. 1. For the purpose of studying the effects of changes in limestone composition it will be assumed that 56.45 per cent C_3S is sought in control of composition. Table 1 then indicates the variations in potential compositions to be expected when the limestone changes from *A* to *B*, *A* to *C*, etc., if the carbonate content is maintained constant without considering the changes in the limestone. On the other hand, Table 2 indicates the changes which will occur under the same conditions if the potential C_3S is maintained at 56.45 per cent. (The values in Table 2 are within 0.10 per cent of that value.)

Considering the change from limestone *A* to *B*, it will be seen that to maintain a constant potential C_3S the carbonate content should be raised from 77.24 to 77.88 per cent (mix No. 6), an increase of 0.64 per cent. If the need for this increase is not observed, and the carbonate content remains at 77.24 per cent, the C_3S content drops from 56.45 to 47.44 per cent (mix No. 2), that is, a decrease of 9.0 per cent. This is due to the fact that MgO, expressed as $CaCO_3$, is included in the carbonate content, but does not enter into the computation of C_3S. That is, the 77.24 per cent carbonate content when limestone *B* is used means less CaO available for formation of C_3S than when limestone *A* is used. It may be noted here that at some plants the control test is a rapid determination of lime content, precipitating the lime as oxalate. In that case, magnesia is not included in the test value, and the effect of the change from limestone *A* to *B* is to increase the potential C_3S about 16 per cent. It is apparent that with either control test, variations in magnesia content may have considerable effect upon burnability of the raw mix if the holding point is not adjusted to take care of the variations when they occur.

It is possible to overcome the effect of abrupt variations in magnesia content by a method which will be presented in another paper. In the present paper it is assumed that changes

TABLE 1—RAW MIXTURES PROPORTIONED TO CARBONATE CONTENT OF RAW MIX NO. 1 (77.24 PER CENT)

	Limestone					Shale
	A	*B*	*C*	*D*	*E*	
(a) Composition of Raw Materials						
SiO_2	3.57	3.57	3.51	4.57	3.57	63.24
Al_2O_3	1.53	1.53	1.50	1.53	2.03	15.78
Fe_2O_3	1.64	1.64	1.61	1.64	2.14	5.32
CaO	49.71	48.71	48.85	48.71	48.71	2.12
MgO	1.20	2.05	1.18	1.20	1.20	1.12
Loss	42.35	42.50	43.35	42.35	42.35	12.42
Carbonates	91.70	92.03	90.12	89.92	89.92	6.56
(b) Percentages of Limestone and Shale						
Limestone	83.00	82.70	84.59	84.79	84.79	
Shale	17.00	17.30	15.41	15.21	15.21	
(c) Composition, Unignited Raw Mix						
	Raw Mix No.					
	1	2	3	4	5	
SiO_2	13.71	13.89	12.71	13.49	12.65	
Al_2O_3	3.95	4.00	3.70	3.70	4.12	
Fe_2O_3	2.27	2.28	2.18	2.20	2.62	
CaO	41.62	40.65	41.65	41.62	41.62	
MgO	1.19	1.89	1.17	1.19	1.19	
Loss	37.26	37.29	38.59	37.80	37.80	
Carbonates	77.24	77.24	77.24	77.24	77.24	
(d) Potential Composition, Ignited Raw Mix						
C_3S	56.45	47.44	78.20	62.49	67.27	
C_2S	20.07	27.73	4.14	15.05	7.57	
C_3A	10.57	10.75	9.97	9.77	10.43	
C_4AF	11.02	11.07	10.80	10.77	12.81	
MgO	1.90	3.01	1.91	1.91	1.91	

TABLE 2—RAW MIXTURES PROPORTIONED TO POTENTIAL C_3S CONTENT OF RAW MIX NO. 1 (56.45 PER CENT)

	Limestone					Shale
	A	*B*	*C*	*D*	*E*	
(a) Composition of Raw Materials						
SiO_2	3.57	3.57	3.51	4.57	3.57	63.24
Al_2O_3	1.53	1.53	1.50	1.53	2.03	15.78
Fe_2O_3	1.64	1.64	1.61	1.64	2.14	5.32
CaO	49.71	48.71	48.85	48.71	48.71	2.12
MgO	1.20	2.05	1.18	1.20	1.20	1.12
Loss	42.35	42.50	43.35	42.35	42.35	12.42
Carbonates	91.70	92.03	90.12	89.92	89.92	6.56
(b) Percentages of Limestone and Shale						
Limestone	83.00	83.44	83.25	84.29	83.90	
Shale	17.00	16.56	16.75	15.71	16.10	
(c) Composition, Unignited Raw Mix						
	Raw Mix No.					
	1	6	7	8	9	
SiO_2	13.71	13.45	13.51	13.79	13.18	
Al_2O_3	3.95	3.89	3.89	3.77	4.24	
Fe_2O_3	2.27	2.25	2.23	2.22	2.65	
CaO	41.62	40.99	41.02	41.39	41.21	
MgO	1.19	1.90	1.17	1.19	1.19	
Loss	37.26	37.52	38.18	37.64	37.53	
Carbonates	77.24	77.88	76.12	76.82	76.50	
(d) Potential Composition, Ignited Raw Mix						
C_3S	56.45	56.45	56.54	56.37	56.50	
C_2S	20.07	19.15	20.01	20.88	17.88	
C_3A	10.57	10.40	10.58	10.00	10.81	
C_4AF	11.02	10.96	10.98	10.84	12.90	
MgO	1.90	3.04	1.89	1.91	1.91	

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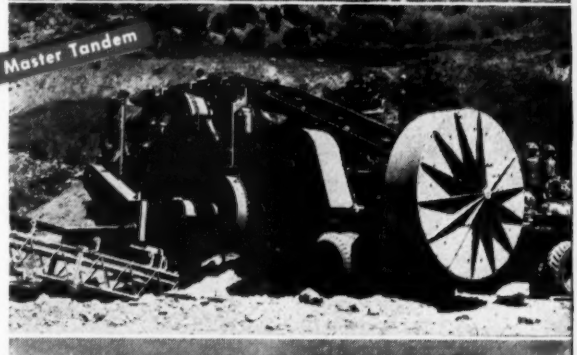

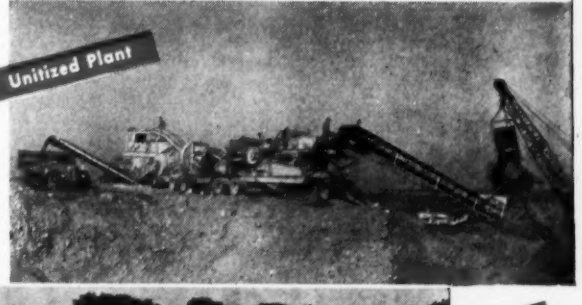

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in raw material composition occur slowly, either naturally or through methods of handling the materials. Under these conditions, determination of the carbonate requirement once a day will lead to appropriate changes in the holding point. For example, mix No. 2 was obtained by maintaining the same carbonate content as mix No. 1, and shows what will occur if the carbonate requirement is not known, and the holding point is consequently not adjusted to take care of the increase in MgO content. Mix No. 2 is 56.45-47.44, or 9.0 per cent too low in potential C_3S. Applying equation 5 to mix No. 2, the carbonate requirement is found to be 77.24 + 0.07 × 9.0, or 77.87 per cent. If the limestone changed in MgO content from limestone *A* to limestone *B*, a determination of the carbonate requirement would lead to raising the holding point 0.07 × 9.0, or 0.6 per cent. This may be seen by referring to mix No. 6, Table 2, which has the desired C_3S content and has a carbonate content of 77.88 per cent.

In the change from limestone *A* to *C*, the ignition loss is increased 1.00 per cent, with no change in relative proportions of the other constituents. The carbonate content should be lowered from 77.24 to 76.12 per cent (mix No. 7) to maintain a constant potential C_3S. If the carbonate content is not lowered, as it should be, the potential C_3S increases from 56.45 to 73.20 per cent (mix No. 3), an increase of 16.75 per cent. At the same time the potential C_2S is reduced to 4.14 per cent, making this a very hard burning composition. Changes in ignition loss may not appear to be a common source of error in proportioning, except in plants using marl, in which the per cent of organic matter fluctuates considerably. It should be noted, however, that moisture which may be present is a part of the ignition loss. From this it is seen that failure to dry test samples completely, or to the same moisture content, may have a disturbing effect upon control operations.

The carbonate requirement, calculated from the compositions of raw mixtures in Table 1 are shown below, with the carbonate content of mixtures in Table 2 which were obtained from the corresponding limestones when proportioning on the basis of potential C_3S.

Mix No.	Carbonates	C_3S	Carbonate Requirement*	Mix No.	Carbonate Content
2	77.24	47.44	77.87	6	77.88
3	77.24	73.20	76.07	7	76.12
4	77.24	62.49	76.82	8	76.82
5	77.24	67.27	76.48	9	76.50

*Calculated by equation 5.

It will be observed that the values obtained by equation 5 are very close to the carbonate content actually required for a constant C_3S, closer than the accuracy obtainable in the carbonate determination.

Effect of Iron Ore or Sand Additions on the Carbonate Requirement

In recent years there has been a demand for cements with lower C_3A content, or lower C_3A and C_4AF content, than can be made from limestone and shale, or equivalent materials commonly available at cement plants. These cements are used for special purposes, such as massive concrete construction where low heat of hydration is desired and concrete exposed to the attack of sulphates. The production of these cements requires the addition of high-iron or siliceous material, or both, to the raw mix. For convenience, the high-iron and siliceous materials will be referred to as iron ore and sand, respectively.

When iron ore or sand is added to a raw mix, the potential C_3S is lowered and the potential C_2S is increased. Since the addition of limestone has the opposite effect, the effect of the iron ore or sand on either the C_3S or C_2S may be balanced by adding a suitable quantity of limestone. The problem, then, is to determine the change in carbonate content when the iron ore or sand addition has been made to a correctly proportioned mix, with sufficient limestone added at the same time to leave the potential C_3S or C_2S unchanged. For example, if control is based upon maintaining a desired potential C_3S in the mix, the "correctly proportioned mix" has the desired potential C_3S, and its carbonate content is the carbonate requirement determined before the change in proportion of iron ore or sand.

The effect of a change in proportion of iron ore or sand on the carbonate requirement may be found from the following equation:

$$F = \frac{1}{100}\left[p_1 - p + \frac{S_1(A - A_1)(p_2 - p)}{S_2(A_2 - A)}\right] \quad (7)^*$$

in which F = factor representing the increase in carbonate requirement for each per cent increase in iron ore or sand

A = C_3S (or C_2S) sought in control

p = carbonate requirement (before change in proportion of iron ore or sand)

A_1 = C_3S (or C_2S) of iron ore or sand

p_1 = carbonate content of iron ore or sand

S_1 = 100 — ignition loss of iron ore or sand

A_2 = C_3S (or C_2S) of limestone

p_2 = carbonate content of limestone

S_2 = 100 — ignition loss of limestone

As indicated above, equation 7 may be applied in control to secure a desired C_2S. The quantities A_1 and A_2 require some explanation. They are obtained by applying equation 1 or 2 to the oxide composition, ignited basis. Since the materials to which they refer are not of portland cement composition, the values obtained appear unreasonable. However, they have a definite significance in mix computations. For example, the C_3S value of a limestone and a shale may be +375 and —645 per cent, respectively. These values indicate that a substitution of 1.0 per cent limestone in place of 1.0 per cent shale, ignited weight basis, raises the potential C_3S in the mix 3.75 — (—6.45), or 10.2 per cent. Because of their definite significance with reference to the effect which they have on the potential C_3S or C_2S in raw mixtures, these apparently unreasonable values of A_1 and A_2 are used in mix computations as though they represented real percentages of these compounds.

Equation 7 is too complex for use in routine mix control operations. Furthermore, it would be unusual to have complete analyses of the limestone and iron ore or sand in actual use at the time that an estimate of the change in carbonate requirement is needed. We must therefore examine the possibility of simplifying the formula by substituting approximate analyses of these materials for analyses representing accurately the materials in use at the time. It might seem that this would be impossible in the case of limestone, since this is present in greatest quantity in the mix. However, it should be noted that the equation is based on the idea that the limestone and iron ore or sand is added to a correctly proportioned mix, represented by A and p. This takes care of the shale and all the limestone except that added to balance the iron ore or sand. Any error due to differences between the average limestone composition and the composition of the limestone in actual use at the time applies only to the comparatively small quantity of limestone required to balance the iron ore or sand. From these considerations it appears feasible to simplify equation 7 by substituting the desired C_3S content for A, and substituting values obtained from average compositions of limestone and iron ore or sand for the quantities designated by subscripts.

Since the simplified formula is based upon average compositions of limestone and iron ore or shale in use at the plant, it is impossible to present a formula here for general use. However, the method of deriving such a formula may be shown by a specific example. Let us assume that at a particular plant the average compositions of the limestone and iron ore are those given in the following table.

(Continued on page 114)

*Equation 7 is derived in Appendix B.

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		Iron Ore	Limestone A
SiO_2		13.34	3.57
Al_2O_3		5.32	1.53
Fe_2O_3		66.43	1.64
CaO		4.57	49.71
MgO		0.79	1.20
Ignition loss		9.55	42.35
Carbonates	p_1=	10.12	p_2= 91.70
C_3S	A_1=	—236	A_2=282
100—ignition loss	S_1=	90.45	S_2= 57.65

Substituting in equation 7,

$$F = \frac{1}{100}\left[10.12 - p + \frac{90.45(50 + 236)(91.70 - p)}{57.65(282 - 50)}\right]$$

$$F = \frac{1}{100}\left[10.12 - p + \frac{90.45 \times 286(91.70 - p)}{57.65 \times 232}\right]$$

$$F = 1.87 - 0.0293p \qquad (8)$$

For all values of the carbonate requirement, p, which are encountered in practice, the value of F obtained from equation 8 is negative; that is, an increase in the proportion of iron ore in the mix lowers the carbonate requirement, and vice versa. To illustrate the use of equation 8, let us assume that the carbonate requirement is 76.2 per cent and that the proportion of iron ore is to be reduced from 3.5 per cent to 1.0 per cent, that is, a reduction of 2.5 per cent. The factor F is $1.87 - (0.0293 \times 76.2)$, or -0.363. The carbonate requirement should therefore be increased 0.363×2.5, or 0.91 per cent, that is, from 76.2 to 77.1 per cent.

Simplified formulas, derived in the same manner as equation 8, are reasonably accurate for all changes in proportion of iron ore encountered in practice. This is a result of the fact that large percentages of iron ore are not used, and also that the amount of limestone required to balance the effect of the iron ore is small. It is because of the small amount of limestone required that the value of F is negative. On the other hand, sand or equivalent material is used in larger quantities, and from four to six times its weight is needed to balance its effect on potential C_3S or C_2S. Equation 7 applies accurately to both iron ore or sand, but a simplified equation derived from it in the same manner as equation 8 is not as accurate in the case of sand. It will be satisfactory for small changes in proportions of sand, but should not be applied to large changes. The maximum change in proportion of sand to which such an equation may be applied will depend upon the extent to which the limestone and sand compositions vary from the compositions used in deriving the equation. The limit cannot be established theoretically. However, since a sample is taken after the change in proportion of sand, for a determination of the carbonate requirement, the maximum change in proportion of sand to which the equation may be safely applied will be learned by observation.

When both iron ore and sand are used, and the proportions of both are changed simultaneously, the effects of these changes can be estimated separately and then combined. For example, if the change in proportion of sand requires an increase of 1.8 per cent in the carbonate requirement, and the change in proportion of iron ore requires a decrease of 0.7 per cent, the net change in the carbonate requirement is an increase of 1.8 — 0.7, or 1.1 per cent.

APPENDIX B

Derivation of Equation for Effect of an Added Material on the Carbonate Requirement

Equation 7 in the text refers to the effect of the addition of iron ore or sand to the raw mix on the carbonate requirement. The equation has a more general significance, however. It refers to the addition of any material, composed of one or more of the major components of portland cement clinker. For example, the equation may be applied to materials used as a source of alumina, to a clay or shale not originally present in the mix, etc. Because the equation does not refer only to the addition of iron ore or sand, reference to these particular materials will be avoided here, and the added material will be referred to as an "additive."

The symbols used in the derivation are shown below.

	Raw Mix before addition	Additive	Limestone to balance additive	Final mix after addition
	Weight fractions of materials (unignited weight basis)			
	$1 - r - s$	r	s	
	Percentages of constituents			
C_3S (or C_2S)	A	A_1	A_2	A
Carbonates	p	p_1	p_2	$p + x$
100-ignition loss	S	S_1	S_2	
	Weight fractions of materials (ignited weight basis)*			
	$\frac{S(1 - r - s)}{D}$	$\frac{S_1 r}{D}$	$\frac{S_2 s}{D}$	

*$D = S(1 - r - s) + S_1 r + S_2 S = S + (S_1 S)r + (S_2 - S)s$

It should be noted that A is the potential C_3S (or C_2S) to be maintained in the mix, both before and after the introduction of the additive. The quantity p is the carbonate content of a correctly proportioned mix before the introduction of the additive, that is, p is the carbonate requirement. The carbonate content is increased by the amount x when the additive and limestone are introduced, as indicated in the last column. It is the quantity x which is sought. The quantity S is 100 minus the ignition loss in the correctly proportioned mix. The value of S need not be known, since S drops out in the course of the derivation. The sum of the fractional weights of the materials is always unity. The fractional weight of the original mix is therefore $(1 - r - s)$.

The percentage of any constituent in the final mix is the sum of the products obtained by multiplying the percentage of that constituent in a material by the weight fraction of the material. Since carbonates are expressed on an unignited basis, the weight fractions on an unignited basis are used in setting up the equation for carbonates. For a similar reason, the weight fractions on an ignited basis are used for C_3S. The equations obtained in this manner are shown below.

Carbonates:

$$P(1 - r - s) + p_1 r + p_2 s = p + x \qquad (1)$$

C_3S:

$$\frac{AS(1 - r - s) + A_1 S_1 r + A_2 S_2 s}{S + (S_1 - S)r + (S_2 - S)s} = A \qquad (2)$$

Collecting terms in equation 1,

$$(p_1 - p)r + p_2 - p)s = x \qquad (3)$$

Upon simplifying equation 2, S drops out, leaving the equation,

$$S_1(A_1 - A)r + S_2(A_2 - A)s = 0 \qquad (4)$$

Eliminating r and s from equations 3 and 4,

$$x = r\left[p_1 - p + \frac{S_1(p_2 - p)(A - A_1)}{S_2(A_2 - A)}\right]$$

Let F represent the increase in carbonate requirement due to the introduction of 1.0 per cent of the additive. Then $r = 0.01$, and

$$F = \frac{1}{100}\left[p_1 - p + \frac{S_1(p_2 - p)(A - A_1)}{S_2(A_2 - A)}\right]$$

which is equation 7 in the text.

APPENDIX A

Preparation of Raw Mix Sample for Analysis

The first step in the complete analysis of a raw mix sample is to render it acid-soluble by fusing it with sodium carbonate or by heating it to a temperature high enough to form a clinker. Fusion with sodium carbonate introduces large amounts of sodium salts into the solution. As a result, the time required for analysis is increased, because double precipitation is required to secure satisfactory accuracy. On that account it is recommended that the sample be prepared for analysis by heating at a temperature high enough to convert it to clinker.

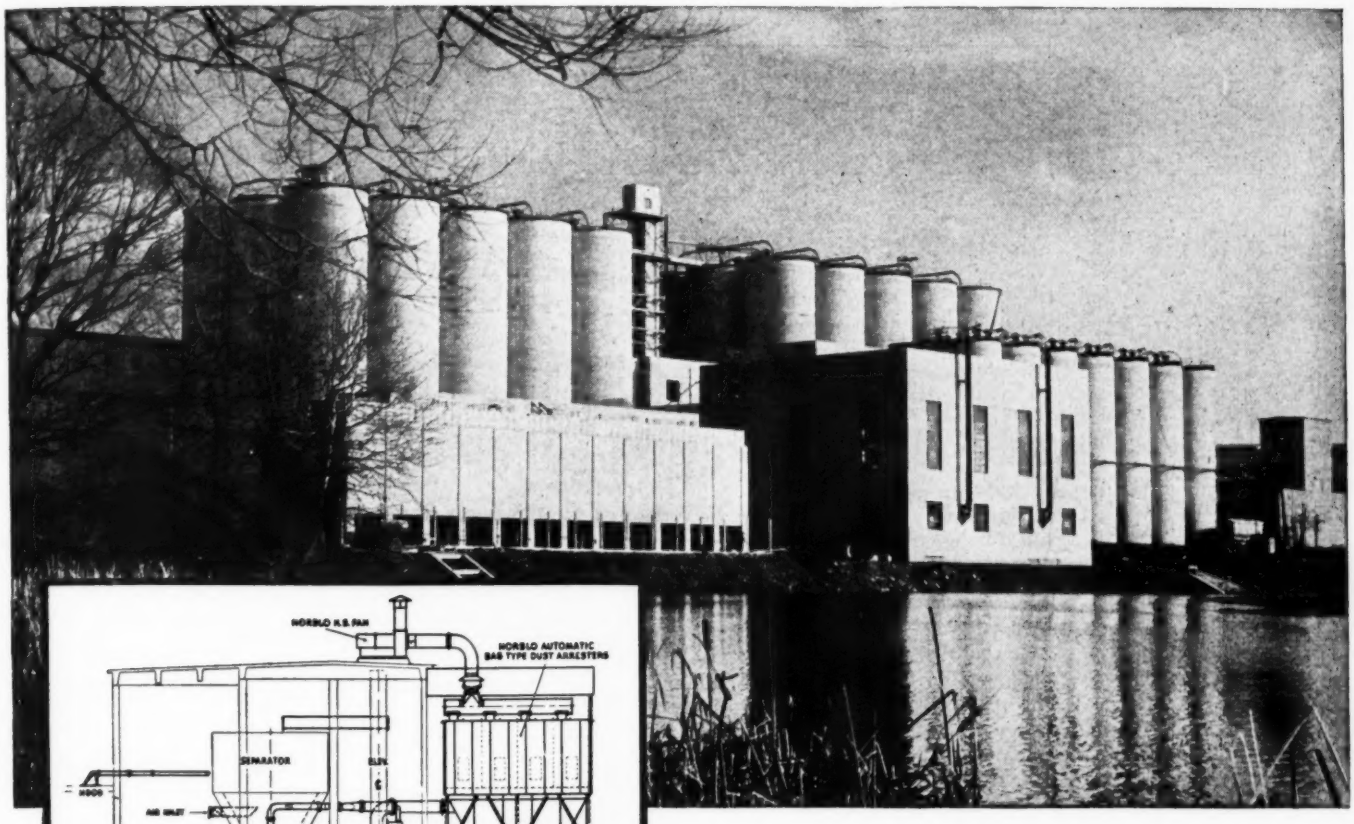
Burners and muffle furnaces commonly used for ignitions and fusions in analytical work do not develop the temperatures required for clinkering raw mix samples. In some laboratories the raw mix samples are clinkered in an electric arc, forming a button more dense than a normal clinker, to be ground for analysis. A high temperature furnace of the "globar" type, in which the heating elements are rods of carborundum, is used in other laboratories.

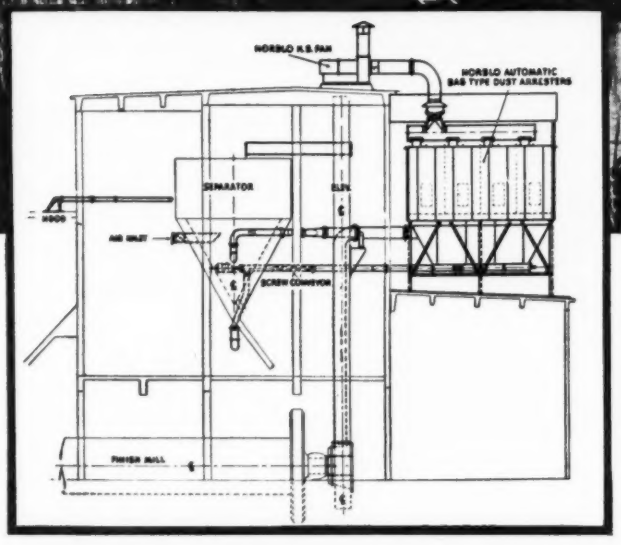
The globar type furnace is convenient in some respects, but has the disadvantage that it must be kept in continuous operation. Repeated cooling below a dull red heat causes the heating elements to deteriorate rapidly. A crucible furnace utilizing gas and compressed air has the advantage that the cold furnace can be brought up to temperature very rapidly, producing a satisfactory clinker in 15 minutes after a cold start. The writer has had no experience with a gas-fired crucible furnace, but our attention has been called to the fact that a crucible furnace supplied by the Selas Company has proved satisfactory.

The time and temperature required for obtaining a satisfactory clinker for analysis will depend upon the composition of the sample. It is advisable to determine the lime or carbonate content before clinkering the sample. Samples low in carbonates require a lower temperature, or less time, than samples high in carbonates. Since other components of the mix also have an influence, the procedure to be followed must be learned by experience with the materials in use at the plant.

Pumice for Block

UTAH PUMICE CO., Salt Lake City, Utah, has reopened its pumice mine which started operations back in 1889. It is indicated that at least 250,000 cu. yd. of high grade pumice is in the deposit. First shipments are going to Buehner Cinder Block Co., which is using it as a lightweight aggregate for concrete products. Other uses are for the chemical industries and for abrasives.





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Need Government Subsidy For Liming Program

First annual convention of National Agricultural Limestone Association gets first-hand picture of 1947 program from government officials

SOIL CONSERVATION practices generally and the federal government's participation in the program for the maintenance and future improvement of the nation's soil fertility were the principal topics considered at the first annual convention of the National Agricultural Limestone Association held at Hotel Statler, Washington, D. C., January 15-16.

Attendance numbered approximately 125 and included representation from the Field Service Branch, Production and Marketing Administration, high officials of the U. S. Department of Agriculture and, as guests, Congressmen and Senators serving on interested agricultural committees.

Officers and Directors

The program was designed for maximum participation by the Regional Directors of the Field Service Branch, in panel discussion of operation of the Conservation Materials Program and in the outline of each regional program, concluding with a business session and the election of officers and the Board of Directors to serve in 1947. Clarence A. Munz was re-elected president; H. C. Gray, executive vice-president, D. U. Smith, treasurer; and Robt. M. Koch, secretary.

The Board of Directors comprises: A. M. Blumer, San Francisco, Calif.; William Clark, Munnsville Limestone Corp., Munnsville, N. Y.; Joseph V. Clisham, The Arundel Corp., Baltimore, Md.; W. H. Cox, Jr., Jesse Allen Lime Co., Nashville, Tenn.; John M. Deely, Lee Lime Corp., Lee, Mass.; Keith B. Dusenbury, Dusenbury Limestone Products Corp., Melvern, Kans.; Nicholas Farber, Farber White Limestone Co., Franklin, N. J.; H. C. Gray, Standard Paving Co., Tulsa, Okla.; Erwin Lanning, P. O. Box 308, Oswego, Kans.; D. L. McCullough, Alabama Aggregates, Birmingham, Ala.; Richard Mayleas, Patterson Limestone Products Co., Inc., New York, N. Y.; William E. Mee, Stanish, Mich.; Clarence Munz, Eastern Rock Products, Inc., Utica, N. Y.; Norbert Neuheisel, Neuheisel Lime Works, Eau Claire, Wis.; E. M. Prettyman, Annville Stone Co., Conshohocken, Penn.; Charles Rich, Swanton Lime Works, Swanton, Vt.; Fred Roberts, Evans-Roberts, Inc., Norristown, Penn.; R. M. Seifried, National Lime & Stone Co., Findlay, Ohio; Donald U. Smith, D. U. Smith & Bro., Ashley Falls, Mass.; Vincent Shea, Allied Minerals, Inc., Adams, Mass.; and E. T. Spidle, Montgomery Limestone Co., Montgomery, Ala.

Robert Koch, the new secretary of National Agricultural Limestone Association. Inc., left, talking things over with President Clarence Munz

Clarence A. Munz, vice-president of Eastern Rock Products, Inc., and president of the National Agricultural Limestone Association, Inc., was the presiding officer for the first general session. Following the call to order and welcome by the president, Mr. Munz introduced Robert M. Koch, who had been elected executive secretary of the association a few days before the meeting by action of the board of directors. Mr. Koch had previously been active with the Production and Marketing Administration in the Northeast region and, in that capacity, had had considerable experience with the liming program. His office has been established at 1426 K St., N. W., Washington, D. C., to administer the affairs of the association, which now has more than 200 members with representation from 35 states.

Next on the program was an "Outline of the Development of the National Agricultural Limestone Association, Inc." by D. U. Smith, treasurer, who traced the rapid development of the agricultural limestone industry since the Soil Conservation Act was passed in 1936. In 1944, when the War Food Administration required greater application of liming materials in order to increase crop production, there was no one to speak for the industry, he said, resulting in the formation of the association. Joseph Mills, Bellefonte Stone Products Corp., N. Y., N. Y., first president, was credited with being its founder, he having called a meeting of the five first members. A charter was granted in January, 1945, and during that year membership was increased to 130.

Legislation

JOHN M. DEELY, Lee Lime Corp., Lee, Mass., reported briefly the legislative committee's work with the subcommittee on agriculture of the House of Representatives, outlining the pre-

Board of directors and officers: Back row, left to right, Richard Mayleas, president, Patterson Limestone Products Corporation; John M. Deely, president, Lee Lime Corporation; D. L. McCullough, Alabama Aggregates; Nicholas S. Farber, president, Farber White Limestone Co.; Norbert Neuheisel, president, Neuheisel Lime Works; Charles Rich, Swanton Lime Works, Inc.; middle row, Vincent H. Shea, president, Allied Minerals, Inc.; Wm. J. Clark, president, Munnsville Limestone Corporation; Fred E. Roberts, secretary-treasurer, Evans-Roberts, Inc., Norristown, Penn.; Edwin M. Prettyman, vice-president, Annville Stone Co., Conshohocken, Penn.; R. M. Seifried, National Lime Co.; officers, front row, seated, treasurer, D. U. Smith, president D. U. Smith & Brother; president, Clarence A. Munz, vice-president, Eastern Rock Products, Inc.; executive vice-president, H. C. Gray, secretary-treasurer, Standard Paving Co.; secretary, Robert M. Koch, Washington, D. C.

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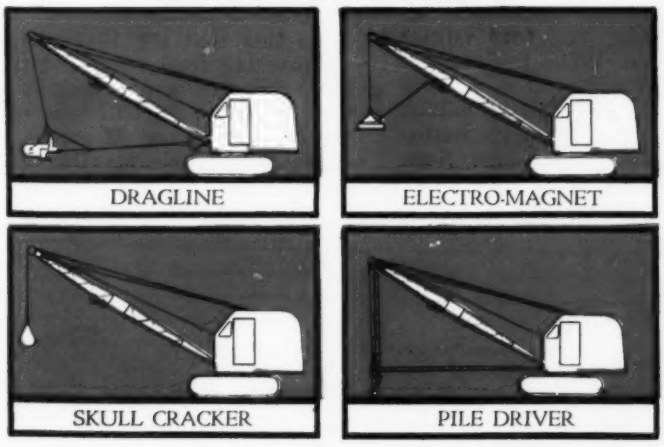

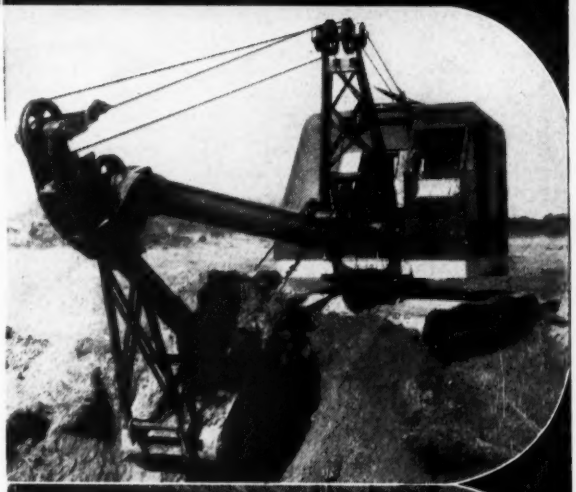

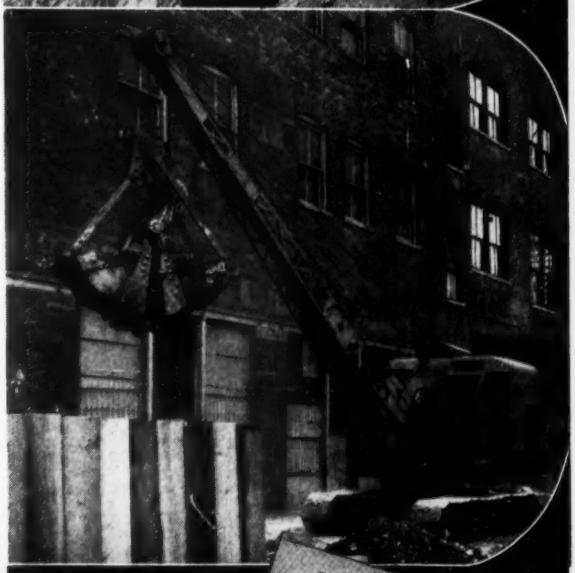

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Left to right: Grant Thompson, assistant director, Field Service Branch, Production & Marketing Administration, U. S. Department of Agriculture; Ralph H. Nolan, president, Nolan Stone Co.; Kenneth M. Banks, president, Worlock Stone Co.; John H. East, director, East Central Region, Field Service Branch

sentation his committee had made in support of the need for continuation of government support. Among the facts presented were that production had been increased during the war 139 per cent over the prewar average, with the result that soils had been depleted more than ever before. The position was taken that if the nation was asked to dissipate its soils, Congress should be receptive to returning fertility to those soils.

The association, through this committee, reminded that agronomists estimate that only 45 per cent of the liming materials needed to retain present soil fertility are being returned to the soil, calling for a definite, specific program to be set up by the Production and Marketing Administration. Mr. Deely had emphasized also that, due to government aid, the industry had developed from a seasonal one to a year-around business, supplying agricultural limestone to the farmer at a considerable saving. In his territory, he said that prices to farmers had been reduced to 25 per cent.

Apparently, President Truman's proposal, in his recent message to Congress, to reduce soil conservation payments from 300 million dollars annually, the figure for the past several years, to 200 million dollars needed clarification and was a matter of some concern. A 300-million-dollar soil conservation program had been approved for 1947, but the money must be appropriated beyond July, 1947, and the proposed reduced budget likely will not be considered to become effective before 1948. The Association's legislative committee has worked hard with Congressional committees in an attempt to maintain the existing budget.

RICHARD EVANS, president, Evans-Roberts, Inc., was presiding officer for the second general session in which the regional directors outlined the programs for their respective geographical areas. In his opening remarks, Mr. Evans commented on the substantial savings to the farmers resulting from the fact that year-around operation had brought lower prices. He complimented the Field Service Branch for its cooperation and the job it had done.

Conservation Program

DAVE DAVIDSON, Director of the Field Service Branch, in turn complimented the agricultural limestone industry for the expansion it had accomplished under severe handicaps, in his remarks on "The 1947 National Agricultural Conservation Program." He emphasized how important the race against soil destruction is and said that no more than one-half the needs in liming materials has yet been spread.

According to his figures, the minimum estimated annual need for agricultural limestone is 52,000,000 tons, which we assume means for soil maintenance only. In 1936, which marks the beginning of the government program under the Conservation and Domestic Allotments Act, four million tons were spread. While the tonnage had increased to 23 million tons in 1945 and to approximately 25 million tons for 1946, he said that the nation is still in the catching up stage. Now, he said, 3½ million farmers working two-thirds of the nation's cropland are participating in the federal conservation program.

In complimenting the AAA committeemen for their tremendous educational job, he said that all groups interested should be promoting conservation in all its activities, including erosion work, irrigation, etc. More educational work must be done, he said, because the nation even now is losing 500,000 good acres of land a year to erosion and depletion. However, this loss was 1½ million acres annually 15 years ago.

As far as soil conservation expenditures have gone, Mr. Davidson said that approximately one-fifth of the total appropriation has gone to materials purchases and that agricultural limestone has been the largest single item from the standpoint of money spent.

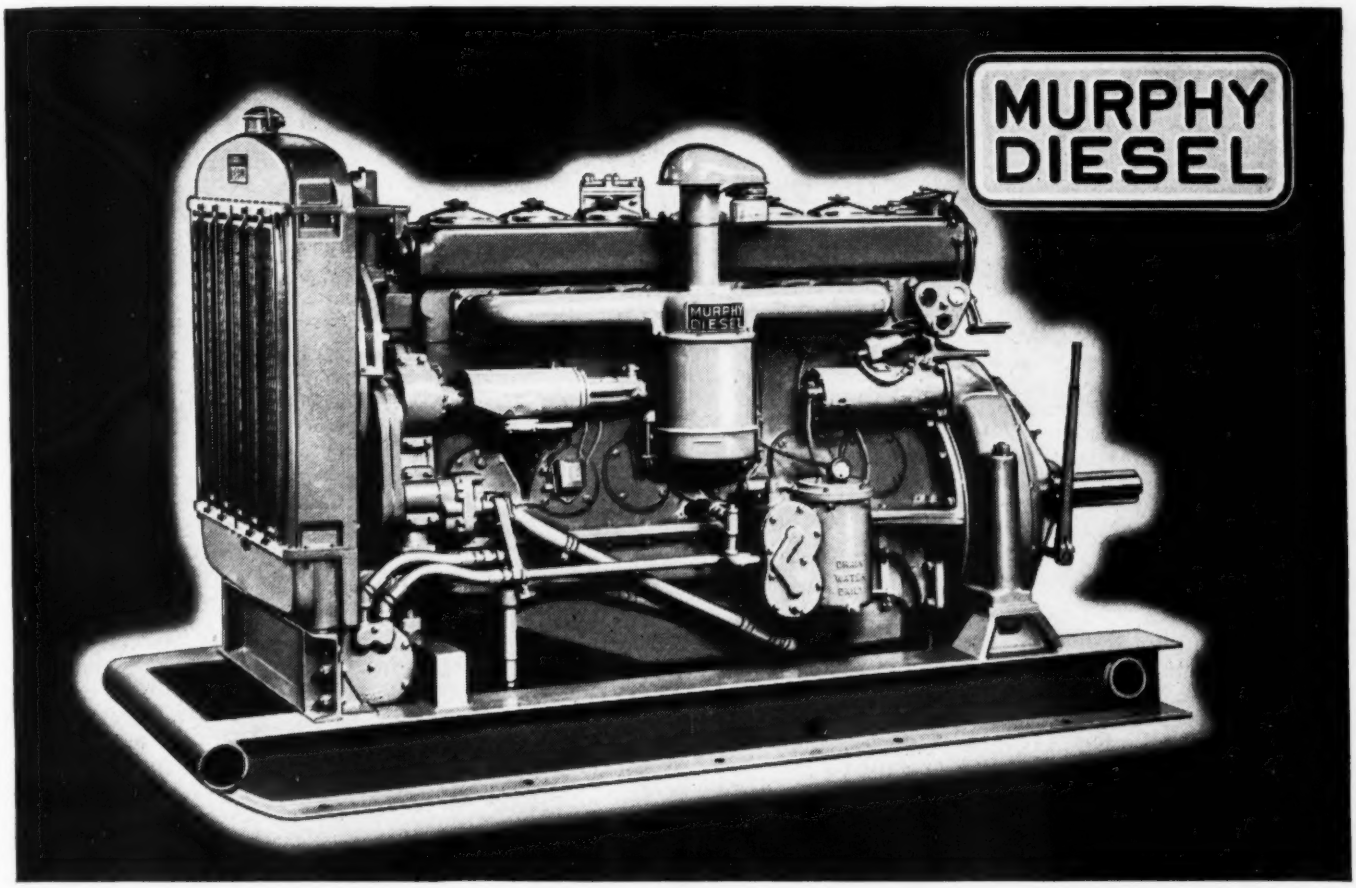
As to the working of the program, he said there is increasing decentralization of the responsibility for carrying out the program, more and more to farmer committeeman at the local level, who choose the practices that are eligible for payment and determine how much cash individual farmers will get. This plan, he said, is a step to insure that the needs of each county will be fairly considered.

Farmers will continue to be expected to carry an increasingly larger share of the cost. In 1943, farmers were required to pay not less than 20 per cent of the cost of agricultural limestone. The figure will be a minimum of 30 per cent in 1947 and a minimum of 40 per cent will be recommended in 1948 so that the available funds may be spread over more acreage and be available for new conservation practices. Assistance for certain conservation practices will be reduced as those practices become routine.

He said that the 1947 program is approaching final form and that the 1948 program, which President Truman urges be curtailed, is entering the planning stage. If smaller funds are made available, Mr. Davidson said the effect would be to spread assis-

(Continued on page 120)

Left to right: Don Maxwell, Washington, Iowa; Guy Mauk, Whiterock Quarries, Bellefonte, Penn., and J. C. Kimberly, Director's Office, Field Service Branch, Production and Marketing Administration, U. S. Department of Agriculture



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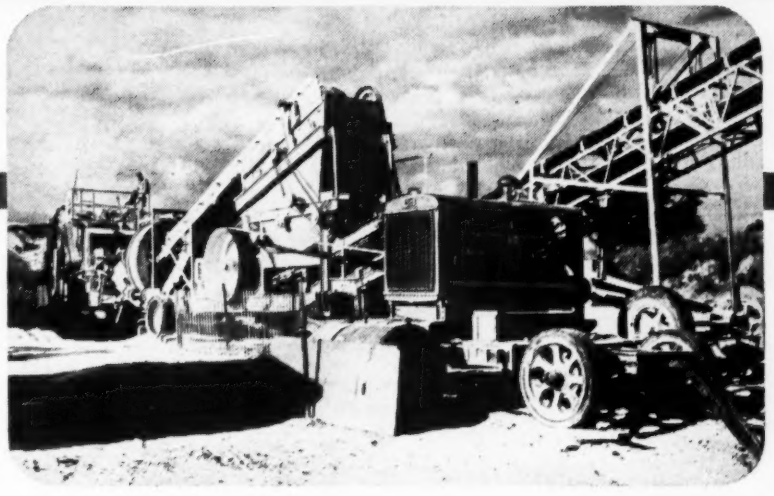

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tance thinner but would not mean blanket reductions on all conservation practices. Rather, emphasis will be concentrated where most needed.

He strongly urged the industry to emphasize merchandising and recommended more widespread use of the purchase order plan, in order to utilize commercial channels insofar as possible. About one-fifth of the total tonnage in 1946 was handled by purchase orders. He suggested that closer sources of supply be developed in order to reduce total tonnage cost and that the industry work very closely with local committees in the determination of approved practices. He also emphasized that the industry keep the state and county committees informed as to available capacity in order to schedule funds properly and that deliveries be spread as uniformly as possible over the year.

Speakers' table at the convention banquet. From left to right: President Clarence A. Munz, vice-president, Eastern Rock Products, Inc.; vice-president, H. C. Gray, secretary-treasurer, Standard Paving Co.; Senator Elmer Thomas from Oklahoma; Senator George Aiken from Vermont; director, John M. Deely, president, Lee Lime Corporation; Fred J. Sievers, director of Massachusetts Agricultural Experiment Station; Representative August Andresen from Minnesota; and director Vincent H. Shea, president, Allied Minerals, Inc.

Regional Reports

JOHN H. EAST, director for the East Central Region, said that that territory which includes Delaware, West Virginia, Virginia, North Carolina, Kentucky, Tennessee and Maryland, has been farmed for many years and the soil is badly worn. More than one-third of conservation funds for the area have been invested in liming materials. The average tonnage applied in the years 1931-1935 was less than 500,000 a year. The tonnage increased to an average of 2½ million a year for the period 1936-1940 and to 4,300,000 tons a year for the 1941-1945 period. The estimate is in excess of 4,500,000 tons for 1946. The estimated annual need is 9,325,000 tons just for maintenance of soil fertility. There is great need for expansion in productive capacity. Mr. East expressed the hope that the road building program will not result in a reduction of the tonnage of agricultural limestone produced.

Mr. East also urged that the industry keep the local committeemen informed as to available capacity in order to guard against over-ordering and the tieing up of funds needed elsewhere, or as a precaution that not enough orders be taken. It is essential to good merchandising, he said, to avoid taking orders that cannot be filled. In closing he emphasized the need for increased production, enlargement of distribution facilities, better local service and close cooperation between the producer and committeemen.

ALLEN M. MANCHESTER, director of the Northeast region, said that 80 to 90 per cent of all farmers in that territory are using agricultural limestone under the soil conservation program. Liming is a necessary first step in a chain of conservation practices, he said, that are working a revolution in farming. There is no point to applying superphosphates to some soils, he said, unless there is lime present to make it available for plant use.

Estimated annual need is slightly less than 6 million tons in that region and farmers are getting one-half of required tonnage. Of the total tonnage, 2 million tons is purchased under contracts, 600,000 tons is bought for the farmers who are repaid by the government and 400,000 tons are purchased direct by the farmer. No purchase orders are used. Mr. Manchester is of the opinion that the farmer will apply agricultural limestone more judiciously as he is required to assume a greater share of the cost.

W. W. CHANDLER outlined the regional program for the North Central region in the absence of director Guy M. Smith, who is convalescing from an operation at his home in Iowa. This region, comprising Illinois, Ohio, Indiana, Michigan, Wisconsin, Minnesota, South Dakota, Nebraska, Missouri and Iowa, had 14 million tons spread in 1945, Nebraska is not in need of liming materials. One-third of the total conservation funds was spent in liming materials and, of the total tonnage, 92 per cent came under the government program. In 1946, 46 per cent of the tonnage was contracted for on a spread basis under the program. In 1946, the purchase order plan was operative in Ohio and Illinois and, in 1947, the plan will be initiated in Indiana.

(Continued on page 123)

LIMESTONE REQUIREMENTS FOR CROPLAND AND PASTURE LAND BY STATES

State and Region	Annual Lime Need — Tons			Consumption On Farms—Tons
	Cropland	Pasture	Total	1945
Maine	160,002	40,000	200,002	92,542
New Hampshire	50,076	13,472	63,548	34,130
Vermont	196,301	38,242	234,543	107,468
Massachusetts	83,670	67,000	150,670	68,995
Rhode Island	11,513	13,652	25,165	11,556
Connecticut	109,803	30,600	140,403	71,955
New York	1,840,171	347,945	2,188,116	829,930
New Jersey	228,570	19,856	248,426	200,149
Pennsylvania	1,584,799	963,137	2,547,936	1,389,103
Northeast	4,264,905	1,533,904	5,798,809	2,805,828
Delaware	64,495	8,720	73,215	44,330
Maryland	282,281	71,543	353,824	295,598
Virginia	1,461,357	721,025	2,182,382	839,090
West Virginia	1,225,718	288,032	1,513,750	290,000
North Carolina	1,491,511	275,291	1,766,802	367,250
Kentucky	805,530	756,283	1,561,813	887,629
Tennessee	1,273,206	600,838	1,874,044	1,500,000
East Central	6,604,098	2,721,732	9,325,830	4,223,897
Alabama	2,337,058	641,504	2,978,562	132,925
Arkansas	382,425	50,838	433,263	115,000
Florida	110,676	32,106	142,782	67,135
Georgia	1,117,657	445,198	1,562,855	89,950
Louisiana	393,890	536,539	930,429	54,641
Mississippi	649,443	263,541	912,984	326,680
Oklahoma	990,882	188,608	1,179,490	288,277
South Carolina	1,468,933	176,364	1,645,297	192,426
Texas	208,911	531,458	740,369	59,343
Southern	7,659,875	2,866,156	10,526,031	1,326,377
Illinois	3,710,693	1,273,417	4,984,110	4,200,000
Indiana	1,752,378	596,908	2,349,286	2,101,000
Iowa	4,970,193	747,556	5,717,749	2,333,000
Michigan	808,060	275,566	1,083,626	580,000
Minnesota	716,614	154,928	871,542	325,000
Missouri	2,296,962	1,951,338	4,248,300	1,290,427
Ohio	2,506,221	892,645	3,398,866	1,350,975
Wisconsin	1,630,594	864,881	2,495,475	1,779,946
North Central	18,391,715	6,757,239	25,148,954	13,960,348
California	88,700	28,500	117,200	48,314
Kansas	1,039,000	72,000	1,111,000	615,480
Oregon	131,931	48,289	180,220	20,500
Washington	40,914	19,724	60,638	22,360
Western	1,300,545	168,513	1,469,058	706,654
Total U. S.	38,221,138	14,047,544	52,268,682	23,023,104

WHEN YOU BUY PRODUCTION EQUIPMENT AND MACHINERY

AGGREGATE PRODUCERS: When you buy production machinery and equipment here's a method of financing the purchase that makes good sense because you can acquire ALL the equipment needed without tying up your working capital.

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Combine the cost of several pieces of equipment in one easy-to-liquidate obligation. Terms arranged to suit your business needs. When you place your orders, tell us what you are buying, balance to be financed, how you want to pay for it. Any of these offices will attend to all financing details for you very promptly. Whenever you obtain delivery, a C.I.T. check completes the purchase.

It's good sense to use C.I.T. dollars in your business to increase your earnings through added production. Get in touch with any of these offices for rates, terms and full information regarding the ways in which we can be of service.

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INCREASED KILN EFFICIENCY WITH THERMALLOY FEED PIPES

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CORROSION and HEAT DAMAGE held to a MINIMUM

THERMALLOY pipes will reduce your shut down time. They outlast others because the alloy has been scientifically developed by metallurgists in a modern laboratory and then proven in service.

Write THERMALLOY into your specifications and get more for your money.

- FEED ENDS
- NOSE RINGS
- DAMPERS
- DRAG CHAIN
- COOLER GRATES

AMERICAN Brake Shoe COMPANY

ELECTRO-ALLOYS DIVISION

ELYRIA, OHIO.

Labor Relations

(Continued from page 106)

sons to work shall not be denied or abridged on account of membership or non-membership in any labor union or labor organization." At the same time Nebraska and Arizona adopted similar constitutional amendments. If the U. S. Supreme Court rules that these conflict with the N.L.R.A., probably the present Congress will clarify the issue.

A somewhat similar issue was decided by the U. S. Circuit Court of Appeals, Ninth District (San Francisco) in a lumber company case. Here an employee was fired on the demand of an A. F. of L. union because he had been expelled from the union as a "C.I.O. spy." The company had signed a closed-shop contract which contained the following clause: "It is the desire of the parties hereto that the employees covered by this Agreement shall maintain membership in good standing in the Union. In order that this desire may be effected and the Union may discipline its members for the effective operation of this Agreement, the Company agrees to release from its employ any person, upon formal demand of the Union, who fails or refuses to maintain membership in good standing in the Union. It is expressly understood and agreed that all present employee members of the Union shall maintain membership in the Union, and present employees who are not members shall secure membership in the Union within a reasonable time and maintain such membership. . . . The Union being the sole judge of its membership, shall have the right to give written notice to the Company that a named employee or employees have not complied with membership according to its rules, and the Company, thereupon, shall within 15 days discharge such employee."

The Court decided that the employer, who admittedly knew why the discharge was demanded, was not required to discharge this employee, because he was merely exercising his right to seek the election of another union as bargaining agent; that he was entitled to do so in the interests of democracy; thus upholding a ruling of the National Labor Relations Board that the employer was guilty of violating Section 8 (1) and (3) of the N.L.R.A. Cynics will point to the fact that this ruling favored C.I.O. vs. A. F. of L., but the Court gives some potent reasons for its decision.

The Court said: "The Board's decision in no way detracts from the benefits Congress conceived in enacting the closed-shop proviso. The Board's interpretation, in addition to confirming the democratic process in bargaining agency elections, prevents the use of the proviso for perpetuation of a particular union's control of the employees once it enters into a closed-shop contract with their employer."

Agstone Convention

(Continued from page 120)

THOMAS L. AYERS, director of the Southern region, reported that 1944 was the best year yet for this area of low income. This area, he said, is constantly undergoing depletion since there is no freezing weather to retard soil deterioration. The annual need is for 10 million tons.

EARLL H. NIKKEL, acting director for the Western region, comprising 43 per cent of the total area of the United States, said that lime is not a major factor in the alkali soils of the west and is not yet needed on the range land. Eastern Kansas has the same lime deficiency as the midwest. In that area, 10,280 tons of agricultural limestone were applied in 1940 and, in 1946, the tonnage had been increased to 880,000 tons. Lime is needed in the coastal areas of California, Washington and Oregon, he said, but sources of supply are too distant.

Panel Discussion

EDWARD PRETTYMAN, Annville Stone Co., presided over the final general session, a regional panel discussion on operation of the Conservation Materials Program in the various sections of the country. The discussion was almost entirely by representatives of the Field Service Branch.

BRUCE M. ENGLISH, representing the East Central region, said that purchase orders are used in some sections of the region and contracts in others. Both purchase plans are liked. John M. Deely expressed some concern that when supply exceeds demand, a condition now becoming evident in the Northeast, farmers may not be satisfied to receive deliveries at anytime throughout the year and the industry might find it difficult to operate on a year-around basis. Seasonal production and delivery is of course more costly and would result in a higher purchase price.

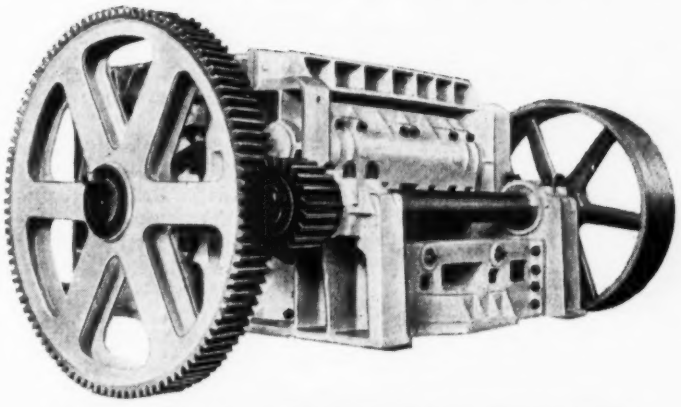
HOWARD M. DOERR, representing the North Central region, discussed the variations in fineness specifications between states and the effects on the industry. He is of the opinion that some standardization is advisable, particularly in bordering states.

Spreader service came in for consideration. According to Mr. Doerr, the charge for spreader service averages 35¢ per ton on plowed ground in the North Central region. One producer expressed an interest in equipment for picking up agricultural limestone already dumped on the farmer's land, for spreading.

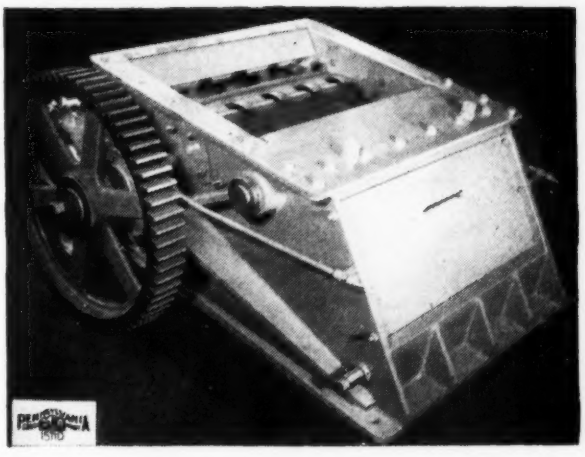
The session concluded with a talk, "Our Annual Liming Needs vs The Annual Liming Material Used," by Dr. C. E. Carter of the Field Service Branch. Dr. Carter agreed with Mr. Doerr that standards for fineness would be desirable, at least for adjoining states but, admittedly, there is much controversy on that subject

"PENNSYLVANIA"

PENN-LEHIGH



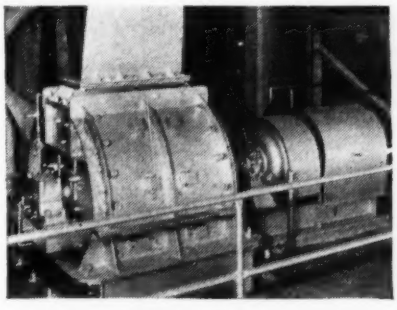
ARMORWELD



Massively STEELBUILT, PENN-LEHIGH and ARMORWELD Series Primary and Secondary Single Rolls, assure low cost, non-clog crushing of Cement-making Materials, Limestone, Gypsum and Industrial Minerals, dry or wet.

Twelve (12) sizes meet the requirements of large, medium and small plants.

Automatic Tramp Iron Separation,—Adjustability for sizing and wear compensation.

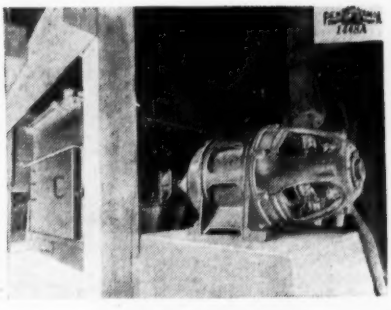


REVER-SIBLE

IMPACTORS

make secondary and finer reductions by repeated smashing impact, against imperforate anvils, without cage attrition, to granular products from materials listed above.

Alternate right and left-hand operation sharply cuts maintenance cost.



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prepare Primary Crusher products to required specifications with high efficiency and low maintenance cost. Specialized for fine reductions of Cement-making Materials, Agstone and Gypsum Rock, in open or closed circuit.

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STEELBUILT CRUSHERS

Made of Acid Open Hearth Steel Wire

Round Strand
Flattened Strand
Preformed
Steel Clad
Non-Rotating

The Service Record of this wire rope continues to make and hold friends.

MADE ONLY BY

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Established 1857

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● That's right — the next several years should be bumper years. All the more reason to equip to handle a full share.

N & F super-concrete stave bins will give you bulk storage and automatic handling of materials—save on labor, reduce truckage, increase production, pay for themselves.

Expert crews will erect them and they're guaranteed. Any capacity.

THE NEFF & FRY CO.

CAMDEN, OHIO

1947 CATALOG READY

BULK STORAGE BINS

Agstone Convention

(Continued from page 123)

and no definite data on which to base standards.

Dr. Carter said that liming of the soil is the key conservation practice; until liming is done none of the other conservation practices can be accomplished. In his opinion, it will take a long time before the federal government is out of the liming business. Limestone requirements and actual consumption, by states, were summarized by Dr. Carter in the accompanying table.

Banquet

JOHN DEELY was toastmaster for the first annual banquet, an occasion distinguished by the presence of Senators and Congressmen on the Agricultural Appropriations Committees who were invited guests.

DIRECTOR FRED J. SIEVERS, Massachusetts Experiment Station, Massachusetts State College, Amherst, Mass., was the featured speaker. Mr. Sievers clearly presented the problem of conserving soil fertility of the nation in an inspired informal talk which he entitled "The Agricultural Conservation Program and Our National Welfare."

The main points developed by Mr. Sievers were that the nation's soils constitute our national wealth and must be maintained fertile for future generations; that if the industry acquires an enthusiasm toward the overall conservation program and its national importance, sales of agricultural limestone will naturally follow.

NORRIS E. DODD, Under Secretary of Agriculture, was the featured speaker at a luncheon January 16. Mr. Dodd recently attended the United Nation's Food and Agriculture Organization Conference at Copenhagen, Denmark, as head of the United States delegation, and commented on his observations of conditions in Europe.

Computing Concrete Materials by Sp. G. Method

DELBERT WHEELER, president of Wheeler Limestone Co., Topeka, Kans., has prepared a pamphlet describing a "Specific Gravity Method of Computing Quantities of Material in One Cubic Yard of Concrete." This company produces concrete aggregates, agricultural limestone, road surfacing rock, and bituminous materials.

Increase Block Production

Fayetteville Concrete Block Co., Fayetteville, N. C., starting production of concrete masonry units in March, 1946, with two George vibrating block machines, is now producing 3000 to 4000 units per day. A. F. Perkins and A. H. Phillips are co-owners of this company, a member of the newly formed North Carolina Concrete Masonry Association.

RYERSON STEEL *IN STOCK*

Call Ryerson when you need steel — any kind, shape, or size. Large stocks are available at eleven convenient plants. Ask for a Ryerson Stock List—your guide to quick shipment of steel.

Principal Products Include:

Bars • Plates • Sheets • Structurals
Inland 4-Way Floor Plate • Mechanical Tubing
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JOSEPH T. RYERSON & SON, Inc.

Steel-Service Plants at:

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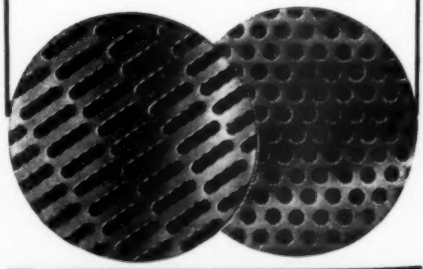
SPECIFY
HARRINGTON & KING

PERFORATED METAL SCREENS

H & K screens are noted for their durability and long service. They are designed for maximum screening capacity of products to meet exacting specifications and to serve well and long. Make your next screens Harrington & King.

Write for illustrated catalog.



The Harrington & King PERFORATING CO.

5650 FILLMORE ST., CHICAGO 44, ILL.
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West Coast Booming

(Continued from page 93)

The oversize from the top deck falls to a triple-deck wet screen that has a 1½-in. top deck, a 1-1/16-in. middle deck, and a ¼-in. lower deck. The fines from the lower deck go to waste as it acts more as a rinsing screen. The other products fall to bins with the larger size returnable to the secondary crushing section. The plus 7/32-in. material from the bottom deck of the upper screen falls to a triple-deck wet screen which has ½-in., ⅜-in., and 7/32-in. wire screens, respectively. The sand goes to three sand drags. The concrete washed sand goes to ground storage under which is a reclaiming tunnel and belt. The minus 7/32-in. material from the lower deck of the top screen can also go to the sand drags and can be used for washed plaster sand.

The minus 1½-in., plus 1¼-in. from the dry scalper goes to the crushing circuit. The minus 3-in. material from this scalper also goes to the crushing circuit as does the plus 3-in. material. A No. 322 Type 'R" AC crusher, No. 5 Newhouse crusher, and 16- x 32-in. Allis-Chalmers rolls make up a rather involved secondary crushing system. These products are elevated and conveyed to two 4- x 12-ft., flat-operated, dry, three-deck, Allis-Chalmers, low-head screens. They receive a split feed from a feed box. The top deck has 2-in. wire cloth; the middle deck, 7/16-in. and 1-1/16-in. wire cloth (finer size at top of screen); and the lower deck is divided into two separate screen meshes; the top half is 3/32-in. and the lower half is ¾-in. screen cloth. Thus this triple-deck screen produces six different products. The material from the top deck can be returned to the crushing system if desired.

All shipments are by truck and considerable area is devoted to ground storage. Eight loading hoppers are filled by a Link-Belt Model 80 shovel mounted on rubber tires, and a Northwest Model 18 shovel. All hoppers are left filled at the end of the day so that any early arriving truck can be quickly loaded. The company has a fleet of eighteen 10-ton capacity trucks that pull a 10-ton trailer. John D. Gregg, Box 110, Whittier, Calif., is the owner; Phil Flynn is superintendent; and John H. Jackson is in charge of transportation.

Still further east of the Azusa district are several new and interesting plants in the Fontana-San Bernardino section. These plants all have ready-mixed concrete batchers on the premises. At Fontana is a new and modern aggregate plant built by the Fontana Gravel Co. This all-steel plant resembles somewhat the new plant of Triangle Rock & Gravel Co., which is being described in detail in this issue. The plant has a capacity in the 250 to 300 t.p.h. range. It was built by the company and is a nice piece of construction and design.

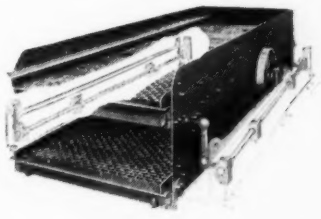
At San Bernardino, the Fourth

Here's Why Profit-Minded Operators Everywhere Choose SECO Vibrating Screens

There's a right SECO for your needs

More Tons Per Hour

1. Results count! Yes, day after day performance records piled up by Seco screens over the last eight years on all types of installations prove conclusively their ability to screen more tons per hour. Here's how.



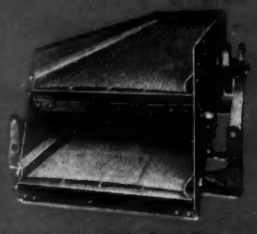
Patented Equalizer Assembly

2. This basic engineering advantage makes the difference! Seco and only Seco has a fully controlled true circular action—that never varies—with less maintenance, keeps every inch of screen surface working at all times.

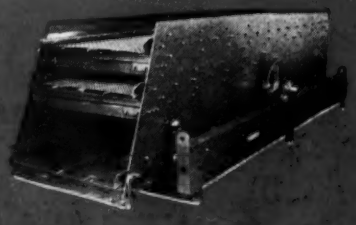
No Bobbing • Galloping or Weaving

3. There's no lost motion—no slowing up of the load—blinding is kept to a minimum—and just think how much longer a Seco screen will hold up on the job with less maintenance—because there's no excess strain on any one part. Get more production per hour—per month—per year. Get a SECO!

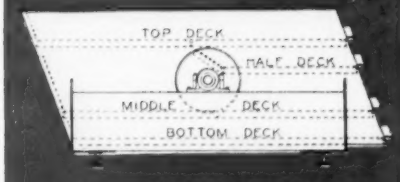
SINGLE DECK



DOUBLE DECK



TRIPLE DECK



THREE AND ONE HALF DECK

To scalp a small amount of oversize and make 3 finished sizes as well as fines.

SECO

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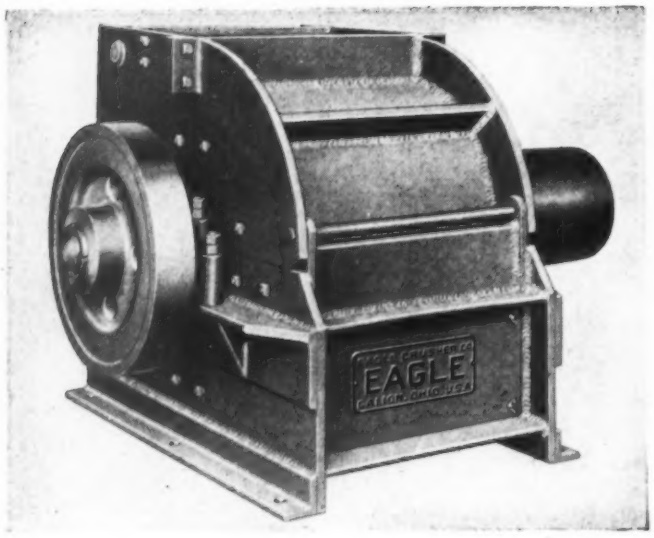
9 Lafayette Avenue, Buffalo 13, New York



EAGLE PULVERIZER — Model 12-24

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COST REDUCTION

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STONE REDUCTION

. . . use an

EAGLE PULVERIZER!

$ Tough as a battleship for the terrific punishment a crusher has to take — yet simple in design.

$ Electrically-welded steel plate frame by the originators of electrically welded crusher frames.

$ All wear plates and screen bars are reversible for greatest economy.

$ Increased capacity and *cubical shape of material* are yours with an EAGLE

See your Eagle dealer or write for details.

EAGLE CRUSHER CO., INC.
GALION, OHIO

Street Rock Crusher Co., built a new plant last year. As the company purchases its water supply from the City of San Bernardino, it was desirable to cut this cost as much as possible so a 50-ft. dia. Dorr thickener was installed and all wash waters go to the thickener. By its use, the company reuses about two-thirds of its water requirements. The plant was built by the Southwestern Engineering Co. of Los Angeles, and probably is one of the few plants in the United States to use a thickener for water reclamation.

Pacific Northwest Plants

(Continued from page 105)

construction are keeping all rock products producers going full blast. Cement plants, aggregates plants and concrete products operators are all very busy. Prices for cement are on the upward trend. Sufficient labor is available with no threatened eruptions from that source.

Oregon has many portable crushing plants, some capable of turning out 600 t.p.h. Many of these plants are built along designs furnished by their owners. Where gravel can be supplied by established dealers this commodity is used as it is cheaper.

Cement plants throughout the state have not been able to supply the demands. One company, the Oregon Portland Cement Co., with plants at Oswego and Lime, Ore., is almost tripling the capacity of its Oswego plant, an increase from 1100 bbl. per day to 3000 bbl.

Oregon has always been a dumping ground for out-of-state cement producers but demands on the Pacific Coast have not allowed any appreciable amounts to come into the state from West Coast producers, however, some dealers, to satisfy hungry customers, are importing portland cement from Oklahoma and North Dakota.

Concrete products are going forward with such a stride that a new concrete products association has been formed with headquarters in the New Washington Hotel, Seattle, Wash. The association is known as the Northwest Concrete Products Association.

The use of pumice brick in Oregon is one of its outstanding developments. Large deposits of pumice, cheaply excavated by power shovels in open pits, are found near Bend, Ore. The Volcanic Materials Co. is one pumice producer in that area, shipping from Tumalo, Ore., into Portland. Most of the pumice used is purchased by the concrete products manufacturers.

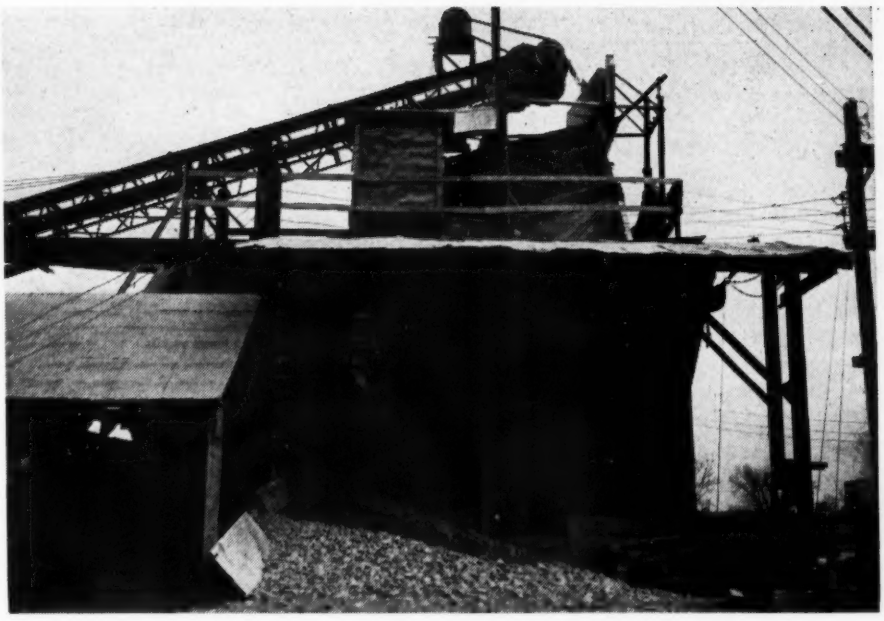
The pumice is a white to yellow tinged product with very little minus 50-mesh material in it. The maximum size is about ⅜-in. It makes a light, strong block that is waterproofed by the application of suitable concrete paint.

Perlite is receiving considerable attention by well financed groups in Oregon. This mineral exfolliates to a

remarkable degree when heated. It is an acid type volcanic rock—almost an obsidian. Some grades are said to expand 30 times the original volume but 20 to 1 is probably nearer the average. After exfolliation the product is white and resembles pumice. It probably will find an extended use for structural purposes. The crude perlite can be shipped to centers of population and there processed, thus making it possible to reach a considerable market. One company is experimenting with a plastic whereby porous perlite (or pumice) concrete masonry units can be made waterproof. It was said that 50 tons of crude perlite would expand to 15,000 cu. ft. of material. Block made of this material will float in water after waterproofing. The same plastic material can, if desired, be used as a binder. Another company has extensive plans for processing and fabricating perlite structural units and will use gypsum as the binding material.

In the sand and gravel industry in Portland, Ore., the Pacific Building Material Co. is building a new plant of all steel and concrete construction. This company has two sand and gravel plants in the district and three ready mixed concrete plants, one of the latter being at Vancouver, Wash., just across the Columbia river from Portland, Ore. The new plant is located at the foot of S. W. Curry street, near the heart of the business section. This is very near the west end of the Ross Island bridge. The company has an older sand and gravel plant alongside the plant under construction. The new plant will use two Telsmith crushers and a Seco scalper screen with a Lippman Engineering Works (Milwaukee) 3- x 10-ft. pan feeder. A Pioneer and two 4- x 12-ft. Simplicity screens will be used for sizing. An 8- x 20-ft. Dorr thickener in conjunction with two Dorrco sizers will be used as a part of the sand recovery system. The Dorrco sizer is a hindered settling device made up of many compartments of different or graduated sizes. Each compartment has a glass side to it so that the performance can be observed by the operator. Each compartment has a fresh water intake that brings about the hindered settling and is controlled through a suitable water valve. The machine has found many uses in the metal mining districts and its adaptation to a sand and gravel plant is a logical extension of its use.

The new equipment is all mounted over nine steel cylindrical bins arranged in three rows of three tanks each. The tanks are completely enclosed by welded steel tops. Under the tanks are reclaiming belts. Some of the aggregates will be stockpiled by stacker belts. This new plant will be ready to operate about March 1, 1947. Sand and gravel will be excavated from the Willamette River by a 5-cu. yd. clamshell rig and delivered to the plant on barges.



Screens 125 Tons Of Limestone an Hour

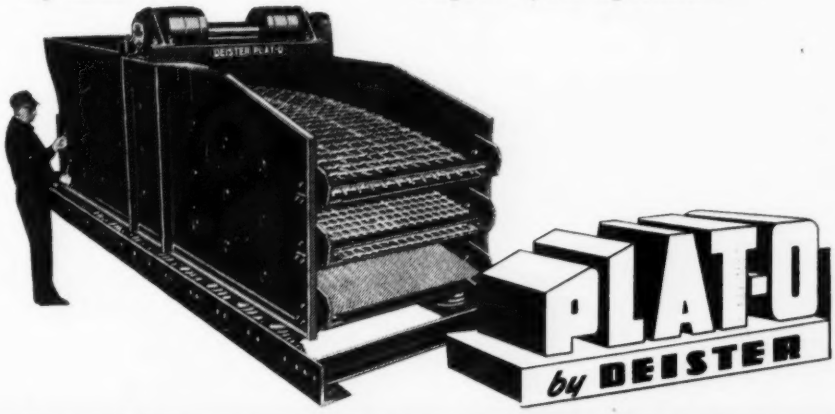
The Meshberger Stone Company, Columbus, Indiana, is running 125 tons of limestone each hour over its new 5′x12′ Plat-O Vibrating Screen, in his production of agricultural limestone. The three-deck Plat-O working as a scalper screen, incorporates 2″, 1¼″ and 3/16″ screen cloths.

The limestone is conveyed to the Plat-O from a crusher. The material kicked off by the 2″ and 1¼″ deck is passed back to a secondary crusher, then goes to a secondary mill. The material which passes through the 3/16″ cloth goes directly to the secondary mill.

The performance of the Plat-O, which has been in operation since early fall, has been highly satisfactory. "I like it," says Mr. Harry Meshberger, owner, "and would buy a Plat-O if I need another."

Bob Studler, foreman, says: "There's no vibration at all in the supporting structure."

Mr. Meshberger is another of the profit-wise operators who has found Plat-O performance profitable. Write Deister Machine Company for information on how Plat-O Screens can improve your operation.



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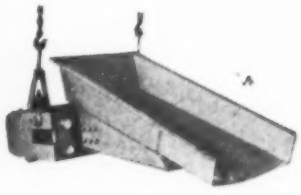
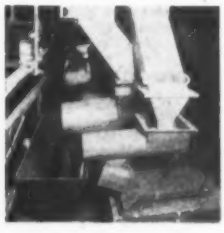
"Vibra-Flow"

VIBRATORY FEEDERS

Provide the Easy, Economical Way to Handle Materials





—by providing a range of capacities in tons per hour to meet your requirements.
—by their electromagnetic operation which eliminates moving, wearing parts and means less maintenance.
—by their ability to handle a variety of materials, from light, fine powders to heavy, coarse ores—hot or cold—dry or damp.

Their rheostat control of rate of flow permits the operator to meet the capacities of dryers, screens, crushers, belt conveyors, etc.

If you'll send us the details of your problem—description of material to be fed, maximum feed per hour, desired length of trough, etc. —our Engineering Department will be glad to submit their recommendations.

Write for Illustrated Folder 9-46

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for the reduction of

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CAPACITIES: 1 TO 50 TONS PER HOUR
FINENESSES: 20 TO 350 MESH

BRADLEY PULVERIZER CO.

ALLENTOWN, PENNA.

Azusa's New Plant

(Continued from page 97)

slice off the top and by taking up the balance with a bottom slice. No water is encountered at these depths but would appear at 185 ft. Gravel is still available for possible deeper excavation. In some portions of the pit the excavation is made from a single high bank. When this is the practice, either a tractor and bulldozer keeps the bank broken down or a dragline mounted on the rim breaks down the face of the pit with an improvised drag. This method, according to the operators, is probably the most satisfactory. It is used quite extensively in the Los Angeles deposits. A road winds from the plant down into the bottom so all equipment can be moved to the surface for repairs.

There are two shovels in the pit, a 2½-cu. yd. Northwest, Model 80, and a 1¾-cu. yd. Koehring No. 601. On the day of our inspection, a new Lima, 1201, Diesel-powered excavator was being shipped from the factory. Dump trucks (seven) haul the pit run about 125 yards up a ramp to the pit hopper. Two trucks can dump at one time at this hopper and all 24-in. boulders and larger are rejected. They will be thrown back into worked out portions of the pit. To date only about 15 such boulders have accumulated so they are not worth much attention.

The discharge rate of the pit hopper is controlled somewhat by heavy chains hung over the opening and a vertically-operated, 4- x 4-ft. heavy steel gate. The electrically-operated vibrating feeder is regulated from a rheostat on the primary crushing floor.

The two 36-in. belt conveyors, one functioning as a stacker, deliver the crushed product to a 7000-ton capacity, live load, surge pile. Under this surge pile runs a third, 36-in. belt conveyor. There is about 1000 ft. of 36-in. conveyors in all. The surge pile off-bearing conveyor operates in a reinforced concrete tunnel. Feed to this gate is from three gates, the middle one having a 36-in. Jeffrey-Traylor electrically-vibrated feeder. The front gate is hand-controlled, and on the back gate a second vibrating feeder is being installed. This last feeder will bring the live load up to the tonnage above stated. The conveyor delivers to a sloping grizzly having 1½-in. openings. This grizzly takes out a great portion of the sand but not all of it. The throughs fall through an open steel spout to the boot of elevator No. 1.

Screening and Classifying

The oversize from the grizzly falls to a 7- x 32-ft. Link-Belt revolving screen that has 16 ft. of 1½-in. perforated plate at the feed end with the balance of 2½-in. perforated plate. The minus 1½-in. material from the upper end of this screen enters the boot of elevator No. 2. The throughs from the end section (minus 2½-in.)

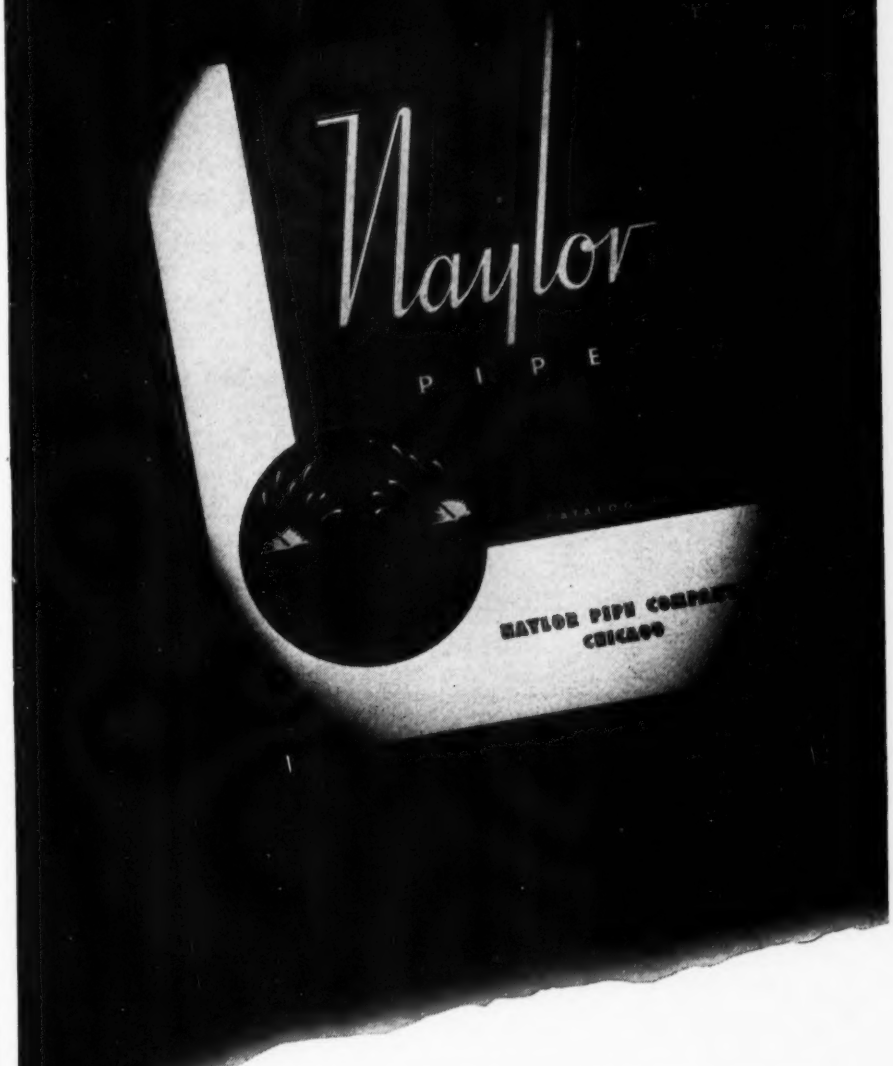
drop to the pair of 4-ft. short-head Symons cone crushers. These discharge to a 30-in. horizontally-operated belt conveyor that delivers the crushed aggregate to the boot of Elevator No. 3. The plus 2½-in. material from the end of the revolving screen goes to the pair of 4¼-ft. Symons standard cone crushers. These discharge to a second 30-in. belt conveyor similar to the one above mentioned. This conveyor serves Elevator No. 4. The scalping revolving screen operates without application of water.

Bucket Elevator No. 1 elevates the sand and minus 1½-in. material to two 4- x 14-ft. Allis-Chalmers double-deck vibrating screens. These operate wet. The upper screen receiving the feed has 1½-in. mesh and the lower deck has 1-in. mesh. The minus 1-in. falls through a steel chute to the lower screen which has ⅜-in and ⅛-in. mesh cloth on top and bottom decks, respectively. The plus 1½-in. gravel from the top screen falls to a common point assembly bin, and along with all other oversize from other screens (to be mentioned later) pass back via a short belt conveyor, to the short head cone crushers and thence to the boot of Elevator No. 3. The minus ⅛-in. flows to a Stephen-Adamson drag classifier discharging to a 100-ton bin. This is the plaster sand and any excess is stockpiled by trucks from this bin. All other products from these screens drop to bins.

Elevator No. 2 delivers to an identical set of screens as No. 1 Elevator. It also operates wet. This elevator receives the minus 1½-in. material from the front end of the rotary screen. The top deck of the upper vibrating screen has 1½-in. mesh, the lower deck has 1-in. The top deck of the lower screen has ⅜-in. mesh, and the under screen is ¼-in. Plus 1½-in. material falls to the reject bin for recrushing. The minus ¼-in. sand flows to a 60-in. Stephens-Adamson drag classifier, identical with the one mentioned above, processing the concrete sand. It can discharge to a 100-ton bin or to a 100-ft. stacker belt. At the time of inspection part of the plaster sand was falling to the bin below, and the balance was being blended with the concrete sand produced from the second drag. The amount of this blending can be easily controlled through a cutter gate on the discharge end of the plaster screen drag.

Elevator No. 3 which receives the output of the short-head cone crusher dumps to a third battery of Allis-Chalmers Ripl-Flo screens that are identical with those above mentioned. They are a part of the crushed rock section and operate dry. The top deck of the upper screen has ¾-in. mesh, and the lower deck ⅜-in. mesh wire. Oversize from the upper deck of the top screen falls to the reject bin to be recrushed. The minus ⅜-in. material passes to the upper deck of the lower screen which has 3/16-in. wire cloth, and the lower deck has 3/32-in. All

BOOK-OF-THE-YEAR
for Mining Engineers



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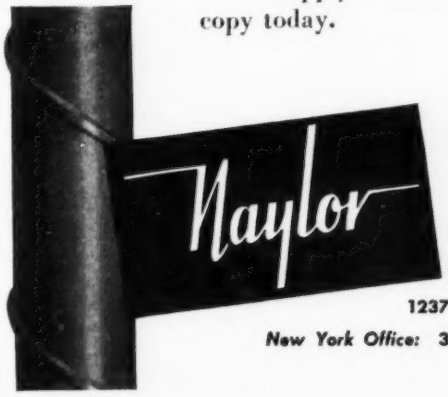

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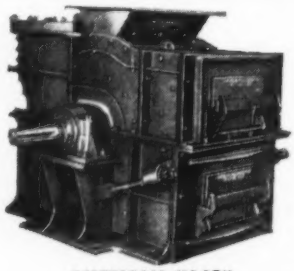
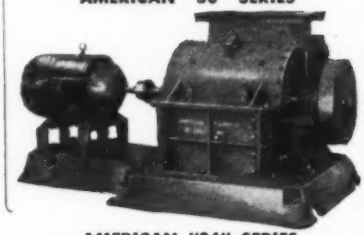


AMERICAN "AC5"

AMERICAN "30" SERIES



AMERICAN "24" SERIES

American PULVERIZER COMPANY
Originators and Manufacturers of Ring Crushers and Pulverizers
1059 MACKLIND AVE.
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Azusa's New Plant

(Continued from page 129)

products, including the stone dust, drop to bins below.

Elevator No. 4 receives the coarse product from the two Symons standard cone crushers, and elevates it to a fourth set of identical vibrating screens. They also operate dry. The upper deck of the top screen has 1½-in. mesh and the lower deck is ¾-in. mesh. Oversize falls to the reject bin for recrushing. Throughs from the lower deck of the upper screen pass to the top deck (⅜-in. mesh) of the lower screen. The lower deck of this screen has its upper half made up of 1/32-in. mesh, and its lower half of 3/16-in. mesh. The upper half produces stone dust. The plus material from this lower deck makes up the No. 5 crushed rock which they refer to as "squeege." All the other products fall to bins below.

All the four elevators are in a row and identically mounted. Similarly the screens are all at the same elevations, and are mounted in rows both vertically and horizontally, making a very nice appearing and orderly arrangement. Even though this description may sound complicated, the arrangement is such that the flow is really simple when once seen. All the screening equipment is mounted on top of the reinforced concrete bins. There are 15 compartments, five in a line above three truckways. Each bin has about 100 tons of live storage.

The following materials are produced: No. 1 crushed rock, 3½-in.; No. 2, crushed rock, 1½-in.; No. 3, crushed rock, 1-in.; Special No. 3, crushed rock, ¾-in. for asphalt rock; No. 4, crushed rock, ⅜-in.; No. 5, crushed rock, 3/16-in.; Rock dust, 3/16-in. (minus); No. 1 washed gravel, 3-in.; No. 2, washed gravel, 1½-in.; No. 3, washed gravel, 1½-1⅛-in.; No. 4 pea gravel, ⅜-in.; and concrete sand and plaster sand. Later a dry sand may be scalped out at the rotary for dry concrete sand.

Trucks load from slide gates that are operated manually. All waste water from these gates is caught in a pan-like arrangement and the water drained off to waste through a 16-in. concrete pipe about 250-ft. long. This disposes of all the slop and waste waters greatly adding to the plant's most excellent appearance. Incidentally, the plant stops every Saturday at 3 p.m., and all hands spend the rest of the day cleaning up everywhere.

At present ground stored concrete sand is reclaimed by mechanical loaders, but a tunnel arrangement is being planned.

As most of the sand processed in Western plants has a little gold, this precious metal is recovered from a short set of riffles that carry the sands to the drag classifiers. Only a small per cent of the total gold in the sand is recovered as there is too much turbulence for efficient settling and no interference with the amount and

quality of the sand is permitted for the purpose of getting a little gold. The company turns the black sands from the riffles over to another concern which pans the gold.

Batching Plants

The company operates a batching plant at Torrence, Calif. This is near the harbor district of Los Angeles. Aggregate is shipped by rail to this plant either over the Southern Pacific or the Pacific Electric. Trucks haul the aggregate to a loading ramp at each railroad's siding a short distance from the plant. No rails actually serve the plant. At the Azusa plant is a small batching plant that will shortly be replaced by a new and additional Noble bulk cement batching plant. This will provide two 2-cu. yd. batchers at this plant, and will permit two trucks to load at one time thereby speeding up truck loading. The new plant will be the full automatic type. Weight - beam photo - relays operate the louvre gate in the cement feed screw, and the motor operating it is automatically started or stopped by the action of these gates. The company has 17 mixer trucks, 11 of which operate out of the Torrence, Calif., plant. Fifty trucks, which include combination dump trailer trucks, etc., also are operated.

All truck deliveries are weighed on a 60-ft. platform scale, thus permitting truck and trailer to be weighed as one unit. These Fairbanks scales are equipped with a Print-O-Meter weight recorder. The scale room is a part of the new office at the plant where all records are kept and are the headquarters of the company. The office covers about 1800 sq. ft.

The following personnel direct the plants and related operations: Hal McRoberts, general superintendent; Albert L. Wise, transportation superintendent; Dewey Howell, truck maintenance; L. D. Howland, engineer of sales and service; and Clarence Lewis, truck dispatcher. Plans for the plant were prepared by Earl G. Boehm, architect, of Los Angeles.

Adds Pipe Machine

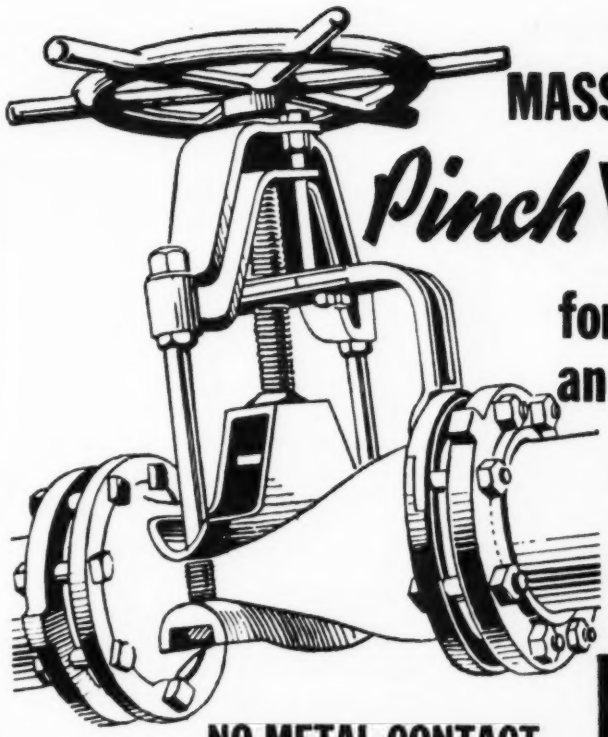
THE CONSOLIDATED SAND AND GRAVEL CO., Columbus, Ga., has installed a new pipe machine to make small size pipe, according to an announcement by Cecil O. Calhoun, vice-president and general manager. Concrete pipe from 4- to 18-in. are being made.

Start Ready Mix Operation

FORD'S REDI-MIX CONCRETE CO., Charleston, S. C., will start operations about February 1. J. Drayton Ford is president and Frank C. Ford is secretary. Plant will have a capacity of 100 cu. yd. daily.

•

MISSOURI CONCRETE PRODUCTS CO., Columbia, Mo., has purchased a ready mixed concrete plant in Helena, Ark., and will set it up in Columbia on what is known as the Drumm tract. Capacity is 75 cu. yd. an hour.



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Successfully used for transporting abrasive and/or corrosive pulps and liquids . . wherever severe wear makes replacements of metal type valves too costly.

Depending upon use, the collapsible sleeve is supplied in either rubber, Neoprene or other synthetics. The valve fits tight, even on solid particles: it contains no packing glands; freezing does not destroy it.

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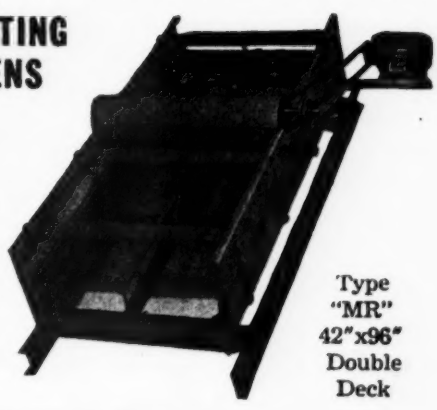
Guaranteed to give you best results on your most difficult separations. UNIVERSALS are of rugged yet simple construction, lowest in first cost and in maintenance. UNIVERSALS have been tried and proved in 28 years of dependable service.

Write for 32 - page catalog on screens and screening.



Type "MR" 42"x96" Double Deck

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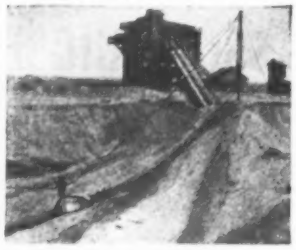

Sauerman Scraper rigged with carrier for gravity return operation.

Sauerman Slackline Cableway moves gravel from pit direct to screens.

INCREASE YOUR

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by moving materials the SAUERMAN Way

Lower costs are the rule when Sauerman Scrapers and Slackline Cableways are used in sand and gravel excavation, stockpiling and other material-handling jobs where the long reach of these machines can be employed to advantage.

Digging, hauling and automatic dumping of any bulk material become one continuous operation, entirely controlled by one operator. First cost is low; upkeep is simple.

Wide range of handling capacities and operating spans.

Let Sauerman engineers study your digging or stockpiling problems. Their advice may save you money and will be given free. Write for catalog.

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For Maximum Reduction, Economy, Production, and Safety

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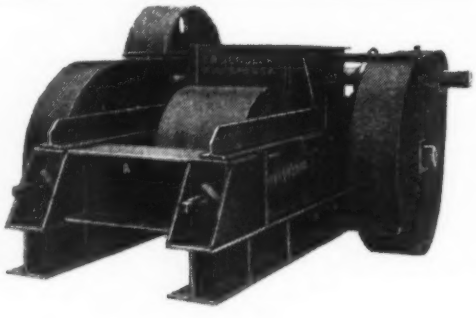

Five Models—Nos. 18, 24, 30, 40, and 56 in a variety of stationary and portable designs.

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Built to the highest standards of quality and precision, includes enclosed all-gear drive,—solid manganese shells,—X-braced frame,—roller bearings throughout,—designed to take many times as much load as it will ever receive in service. You may choose smooth, corrugated, step tooth or a combination of any of these rolls in the proper diameters to produce the desired stage of reduction in combination with jaw or other primary crushers.

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New Incorporations

Cedarburg Building Materials Corp., Cedarburg, Wis., has been incorporated to manufacture, buy or otherwise acquire, sell, transport, distribute and deal in cement, clay, stone, etc., with a capital of 250 shares at $100 per share.

Deal Gravel, Inc., Elkhart, Ind., has been organized to operate a gravel pit and sell sand, gravel and concrete, with a capital of 1000 shares, no par value. Incorporators are Clarence C. Deal, Joyce E. Deal and June E. Deal. Clarence C. Deal is the agent.

Ed. J. Murphy Sand & Gravel Co., Seymour, Wis., has been incorporated to deal in sand and gravel, with a capital of 250 shares, par value $100. Incorporators are Ed J. and Stella Murphy and John McCormick. Michael Burns, Seymour, is the attorney.

Lima Building Stone Quarry, Inc., Wilmington, Del., has been organized with a capital of 1000 shares, no par value. Principal office, Leslie H. Gluckman, Wilmington.

Stone Supply Co., Houston, Texas, has been incorporated by H. A. and John N. Stone.

Andersen Sand & Gravel Co., Saginaw, Mich., has been incorporated by Frank N. Andersen with $55,000 common stock.

Tennessee Portland Cement Co., Wilmington, Del., has been incorporated to deal in cement, lime, etc., with a capital of $1,648,924. Principal office, the Corporaton Trust Co.

Manufacturers' News

Bemis Bro. Bag Co., St. Louis, Mo., announces the retirement of Fred Houser, superintendent of the Memphis, Tenn., plant for 25 years, and the appointment of Louis E. Pounders, former assistant superintendent, to succeed him.

Farrel-Birmingham Co., Inc., Ansonia, Conn., has appointed Arthur B. Pike as Boston area representative, with offices in Lexington, Mass.

Lincoln Electric Co., Cleveland, Ohio, has moved the San Francisco office and warehouse to Emeryville, Calif., under the direction of L. P. Henderson, district manager and welding engineer; the Los Angeles office to 1500 Calzona St., Los Angeles, with J. B. McCormick in charge; and the Birmingham office to 113 N. Ninth St., Birmingham, with J. E. Durstine in charge.

R. G. LeTourneau, Inc., Peoria, Ill., has appointed Robert C. Judd as market research manager. He formerly conducted his own sales research firm. Mr. Judd replaces Wendell Richards, who resumes his district sales representative activities.

Marion Power Shovel Co., Marion, Ohio, has announced the election of Harvey T. Gracely as president and general manager, succeeding M. E. Montrose. Mr. Gracely's first association with the company was in 1901 as an employee in one of the factory stock rooms. Later he was transferred to engine subassembly work and shortly afterward he went into the engineering department as a draftsman. Three years later he started devoting his attention to designing and detailing floating dipper dredges, and soon became chief of the dipper dredge section. In 1914 he resigned and engaged in drainage contract work in Mississippi. In 1919, Mr. Gracely returned to the company as advertising manager. Four years later he was made assistant sales manager and about a year later was appointed general sales manager, holding this position 14 years. In 1944, Mr. Gracely was elected a member of the board of directors and a year later was made vice-president.

Harvey T. Gracely

Le Roi Co., Milwaukee, Wis., has purchased the Cleveland Rock Drill Co., of Cleveland, Ohio, a division of The Cleveland Pneumatic Tool Co. Russ R. Morgan, formerly secretary and sales manager of the rock drill company, will head the new division, and John M. Dolan, vice-president in charge of sales, will head the integration of sales activities of all LeRoi products. The LeRoi-Cleveland product line in current production includes a complete series of rock drills.

Russ R. Morgan

Easton Car & Construction Co., Easton, Penn., has elected W. E. Farrell, president and founder of the company, as chairman of the board of directors. He will be succeeded as president by his son, J. C. Farrell, formerly vice-president. R. C. Haggerty, secretary-treasurer has been elected vice-president. Mr. W. E. Farrell, a graduate of Vanderbilt University, where he received his degree as a mining engineer in 1891, will remain active as chairman of the company which he

J. C. Farrell

To Production Executives

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If your production bottleneck is in the finish grinding, TDA can help you increase production immediately.

1 TDA increases production up to 30%

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2 TDA increases production immediately.

You can get TDA immediately. There is no long delay for equipment so that you start getting your increased cement production right away and your plant is not placed at a competitive disadvantage under today's increased demand for cement.

3 TDA is flexible.

TDA can be used now during the emergency demand and discontinued when production again becomes normal. TDA users are not left with surplus equipment on their hands with its corresponding load of fixed charges that may not have been amortized.

4 No need to buy at today's inflated prices.

Using TDA, you can apply the savings that you get from the increased production and lay them aside toward the purchase of new equipment when the present inflated values have passed.

It costs you nothing to investigate TDA, and we believe that it will be your answer to your immediate demand for more cement. One of our trained engineers will be glad to go over the facts about TDA as proved in hundreds of installations with all kinds of clinkers.

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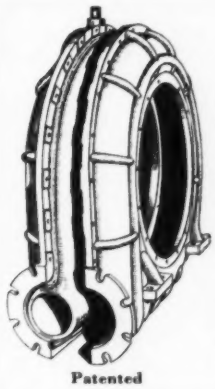

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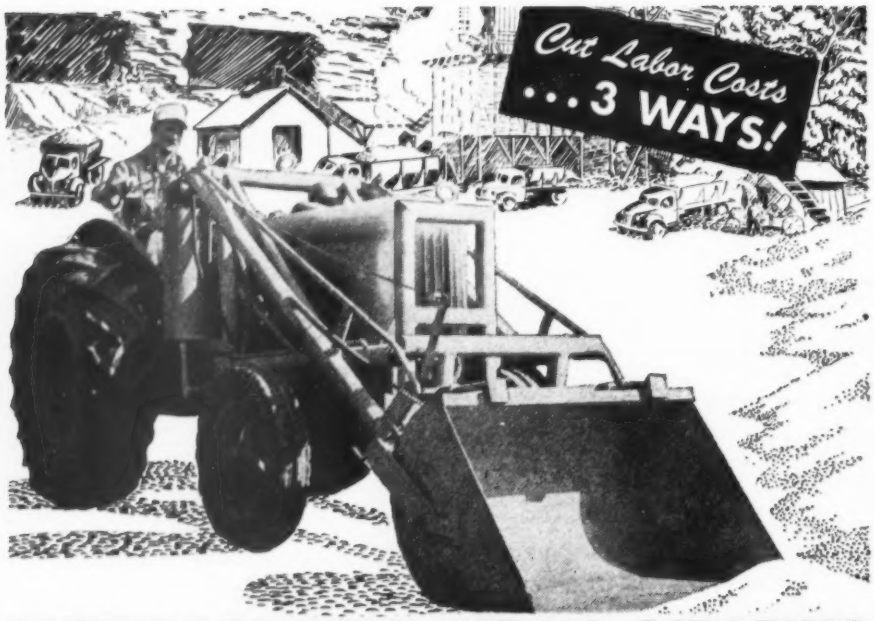

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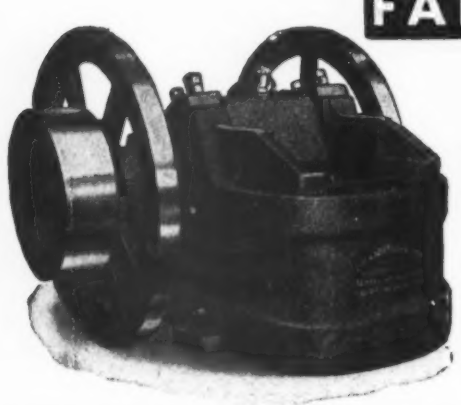

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founded in 1914. The younger Mr. Farrell joined his father after his graduation from Yale Sheffield Scientific School in 1924, and became vice-president in 1934. Mr. Haggerty has served with Easton since 1916, and became secretary-treasurer in 1924.

Stearns Magnetic Mfg. Co., Milwaukee, Wis., has appointed Gordon E. Medlock as assistant manager of sales and repairs for the brake division at Milwaukee.

Chain Belt Co., Milwaukee, Wis., announces the appointment of Austin K. Thomas as sales manager of the construction machinery division. Mr. Thomas has been associated with the construction machinery industry for over 20 years. He was formerly connected with a large Eastern manufacturer of construction machinery, working first as a service engineer, then as a member of the sales department, and lastly as manager of a district sales office. He then joined the organization of a construction machinery distributor. He joined the Chain Belt Co. as Eastern District manager, with offices in Philadelphia.

Austin K. Thomas

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has announced that the general machinery division's district offices henceforth will be grouped under the direction of regional managers, who will have a staff of specialists, and will operate as self-contained field units. The first regional managers appointed were W. F. Taylor, who will supervise the New England area; D. S. Kerr, who will handle the Southeast; J. L. Pratt, who will manage the Southwest; and A. J. Schmitz, who will continue to direct operations in the Pacific Coast area.

Robins Conveyors Division, Hewitt-Robins, Inc., Passaic, N. J., has announced that R. U. Jackson, formerly manager of the Charleston, W. Va., office, has been elevated to the position of coordinator of mine conveyor sales. Replacing him as manager of the West Virginia office is J. W. Wantling, inventor of the special Robins Exiptex dewatering screen.

Nordberg Mfg. Co., Milwaukee, Wis., has acquired certain manufacturing assets from the Busch-Sulzer Bros.-Diesel Engine Co. of St. Louis, Mo., which will continue its Diesel engine business as a division of the Nordberg Mfg. Co.

Joseph T. Ryerson & Son, Inc., Chicago, Ill., has appointed Park Sanderson as manager of the Boston plant, to succeed Herbert C. Wills, who is retiring.

Mixermobile Co., Inc., Los Angeles, Calif., announces the removal of the Los Angeles office to 245½ South Western Ave.

CONCRETE PRODUCTS

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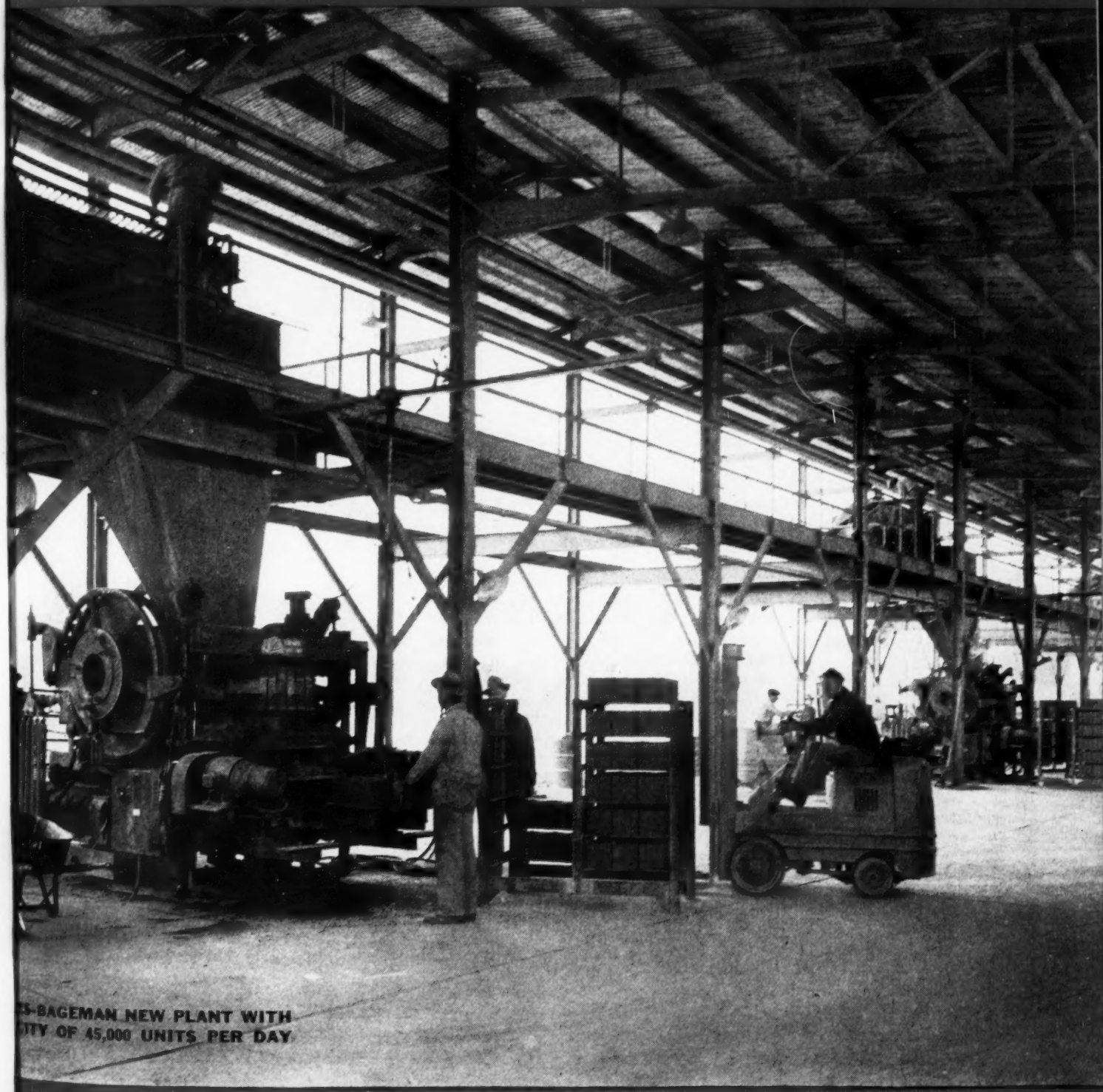
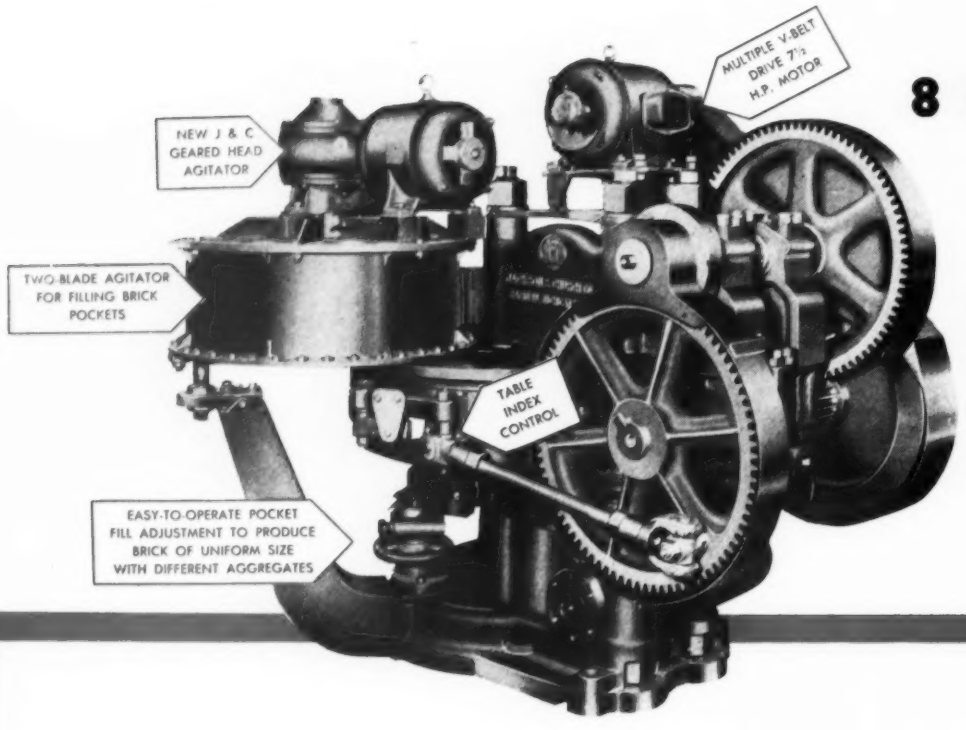
FEBRUARY 1947



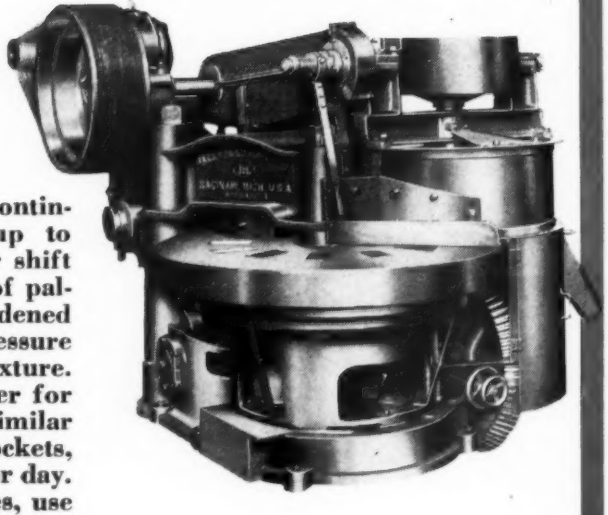
S-BAGEMAN NEW PLANT WITH
ITY OF 45,000 UNITS PER DAY

iggest Products Plant in California

GET 14,000 CLEAN, SHARP-EDGED BRICK PER 8 HOUR DAY


MULTIPLE V-BELT DRIVE 7½ H.P. MOTOR
NEW J & C GEARED HEAD AGITATOR
TWO-BLADE AGITATOR FOR FILLING BRICK POCKETS
TABLE INDEX CONTROL
EASY-TO-OPERATE POCKET FILL ADJUSTMENT TO PRODUCE BRICK OF UNIFORM SIZE WITH DIFFERENT AGGREGATES

Left: J & C Model NC Brick Machine turns out 14,000 brick per 8-hour day. Below: Model A Brick Machine, capacity 28,000 smooth, sharp-edged, square cornered concrete sand-lime brick per day.



Just install one or more of the new J & C Model NC Brick Machines in your plant . . . and watch the brick pile up for delivery to your most exacting customers in the building trade. With 6 pockets in the rotary table turning out clean, sharp-edged, square-cornered brick in a continuous molding cycle, this machine produces up to 14,000 concrete or sand-lime brick every 8-hour shift . . . smoothly and economically, without the use of pallets. Automatic feed control precisely fills each hardened steel-lined pocket, and approximately 75 ton pressure compresses every brick to true size and uniform texture. Modern gear head design with independent power for feeder and feed agitator. The Model A Machine, similar in principle to the Model NC but built with 12 pockets, turns out 28,000 brick of the same high quality per day. Regardless of which size your production requires, use the brick machine that turns out the strong, sharp-edged concrete and sand-lime bricks preferred by contractors and masons . . . use J & C Brick Machines. Write for literature.

Pay us a visit at the Concrete Industries Exposition, Hotel Sherman, Chicago.

A PRODUCT OF J&C

JACKSON & CHURCH CO., SAGINAW, MICHIGAN

WORK WELL DONE SINCE '81

Material storage area with stockpile of pumice aggregate. Plant in background

Largest Products Plant on West Coast

Wailes-Bageman, Inc., widely known as manufacturer of precast concrete, completes modern concrete block plant

ONE of the nation's outstanding concrete products plants, in capacity, diversity, equipment, engineering and operation, is the new plant of Wailes-Bageman, Inc., Los Angeles, Calif. It is the modern outgrowth of the pre-war Wailes-Bageman Co., which in the years 1940-1942 developed a rapidly expanding business in precast concrete both in southern and northern California. The firm name was changed in August, 1946.

The main plant, built on East 27th Street in Vernon, centrally located in the Los Angeles metropolitan area, occupied a portion of the land which is the site of the new larger operation. The original business involved a wide range of prefabricated concrete featuring precast concrete joists. Up to the time World War II interrupted its activities, housing project contracts employing precast joist floors had reached a total of between 4000 and 5000 family units, but the last of this work was completed in the fall of 1942.

In the war period, shop facilities and experience available in the organization prompted the company's entrance into steel pontoon construction for the U. S. Navy. The success of this effort is indicated by such accomplishments as the winning of the Army-Navy "E" Award and by demonstrating the ability to organize and operate three plants at one time. During the war, the company became one of the largest producers in the country of large pontoons and pontoon gear used for naval landing equipment.

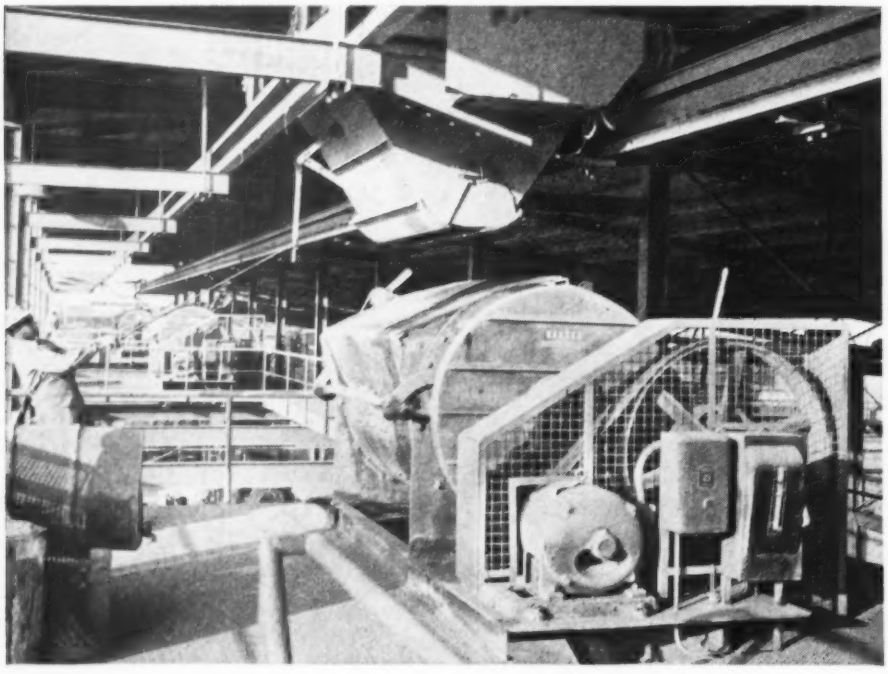
With the close of the war, it was necessary to make new plans and the decision to reconvert to concrete products was the result. The products field was carefully studied, and it was apparent that a larger, more complete plant for the production of a broader range of products was fully justified. It appeared desirable to build the plant by stages and to start one operation at a time, while providing the basic facilities for full-scale future production.

Early in 1946, reconversion was under way. The first step was the acquisition of adjoining land, resulting in a 13½-acre site for the new plant. Studies had determined the desired plant layout and the logical order of construction. Masonry units were in demand and offered a future market capable of steady development, hence it was decided to combine basic construction and a masonry unit plant as the initial project. Material handling equipment had been installed and the first Besser machine was in readiness in June, when plant operation was started, making both brick and block. These materials were then used to construct the steam curing chambers, and in the meantime, two additional Bessers were being placed.

Continue Manufacture of Beams, Joists, Floor and Roof Slabs

Further plant developments which are a part of the over-all plan include the early construction of a plant for the manufacture of Flexicore floor and roof slabs, for which the corporation holds the California rights. It is also planned to eventually double the masonry unit plant and to add facilities for the manufacture of other forms of structural concrete, including various types of beams and slabs, joists; products similar to those produced prior to the war.

In line with a trend which appears significant in the field of concrete products, Wailes-Bageman, Inc., plans to manufacture all of its products of lightweight concrete. The greater ease and lower cost of handling and transporting the material, the lessening of dead loads which result in design economies, the higher values in insulation and fire-resistance and other desirable properties of light-



Upper level mixer platform with travelling batch lorry above

weight concrete seem sure to overbalance its higher initial cost.

It is impossible in a brief article to describe in full detail the many ingenious and practical features of this up-to-date plant, designed for continuity of operation, economy and effective control of the product, with provision for future expansion. It will perhaps suffice to outline the concrete masonry plant, its equipment, arrangement and distinctive features, stressing the fact that all basic equipment and installations have been engineered to provide for the full load of anticipated future production.

Mass Production Facilities

The aggregate, a lightweight crushed volcanic pumice from the Inyokern area northeast of Los Angeles, is delivered to the plant by rail, dumped from the cars into under-track hoppers, then elevated by bucket elevator to a horizontal conveyor which carries it to stockpiles with storage of about 9000 cu. yd. The stockpiles feed the pumice aggregate through underground hoppers to a belt conveyor, 260 ft. in length, installed in a reinforced concrete tunnel. It is then elevated by bucket elevator into bins located directly over the Noble automatic batching equipment. This equipment comprises a six-compartment, 200-ton bin with five-beam, automatic, all-electric batching control and air-operated gates. Cement handling facilities provide for either rail or truck tanker deliveries. At railside stands a 900-bbl. cement storage tank with Fuller-Kinyon pumping equipment. This storage unit is connected by 5-in. pipeline with the cement silo at the batching point. The latter, of 750-bbl. capacity, has elevator equipment to handle bulk cement deliveries made by truck.

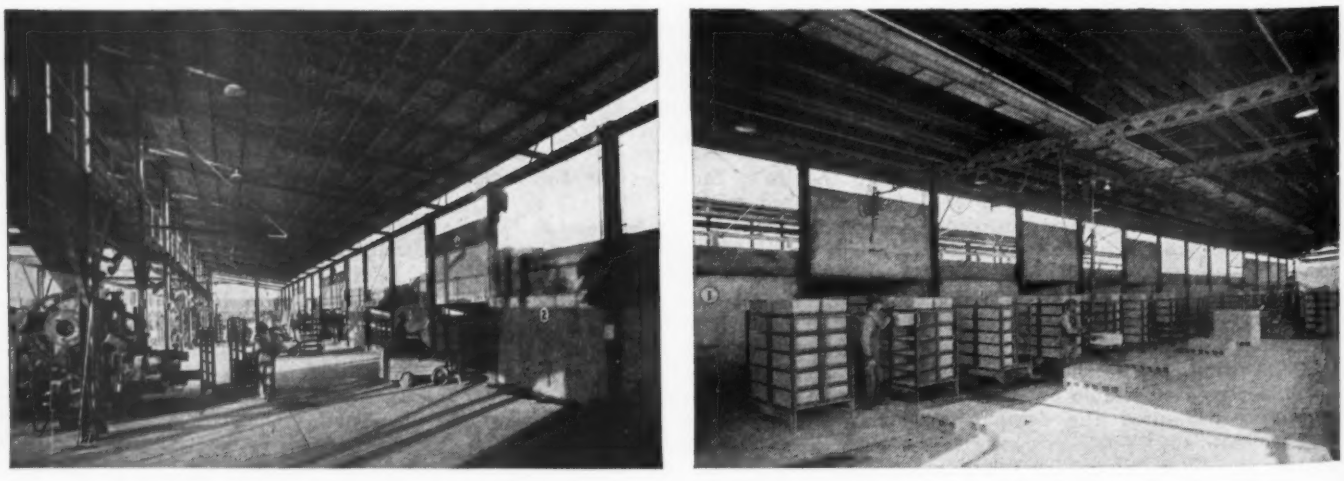
The dry-mix from the batching plant is weighed out into a hopper car which travels on an overhead track running the full length of the mixer-block machine building. This car charges in turn the 50 cu. ft. Besser mixers, each of which is equipped with an automatic water meter. The mixed concrete falls into hoppers and thence into the Besser machines, three of which are now in operation, with provision for the installation of an equal number of additional units.

Machines are of the largest and latest type Besser Super Vibrapac. The three machines now in operation are capable of producing 45,000 8- x 8- x 16-in. units in 24 hr., or a larger number of units of smaller size. For example, 450,000 brick of common brick dimensions can be made. These brick resemble in appearance a wire-cut brick, with clean-cut surfaces and true to dimensions. Both block and brick are made under a trade name as W-B Precision Concrete Products.

Block or brick made by the Besser machines are taken off by means of air-operated off-bearing equipment, and placed in steel racks, which when filled are moved by fork-lift trucks to a cell of the steam curing chamber or kiln. Opposite each machine is a kiln of four cells, each of which is filled in three or four hours of operation, after which the door is closed for the steam curing period. Aisles are provided between kilns for the return of racks after use.

High Temperature Curing

Each kiln consists of four cells, each 13 ft. wide, 60 ft. long, and 8 ft. high. The walls and roofs were constructed of W-B blocks, the roofs being of tile-and-joist type, with joists 20 in. on centers and a 3-in. top slab. The kilns are of through type with insulated metal doors at each end of the structure which slide vertically. Curing is by means of high-temperature steam at about 208 deg. F.; both temperature and humidity control are provided by automatic regulating devices. Steam coils on the cell walls furnish radiation and steam is re-



Left: Showing battery of high-capacity block machines with lift trucks moving block from machine to curing rooms. Right: block moving from curing chambers to cubing area

Looking over the roof of steam curing chambers, showing elaborate system of piping and blowers for circulating steam and air

leased as required for proper humidity. The curing period is 12 to 13 hours, the latter portion of which is utilized for a drying period, permitting the removal of cured units with a moisture content well within specification limits. Strength also can be readily controlled and adjusted by means of this curing process, combined with mixture design and proportioning. The lightweight insulating concrete used in the masonry plant operation is in the weight range of 90 lb. per cu. ft.

Cranes and Lift Trucks Move "Cubed" Block

When curing is completed, the units move out from the kilns to the cubing area, which is characterized by well-engineered facilities for economical handling. A specially designed crane bridge and tram-rail give flexibilty to the cubing operations. Each four-cell kiln is served by one overhead crane, and each crane serves air-operated cubing equipment. Normal cubing operation consists of laying down a bottom course with horizontal cells arranged to receive the lift forks; 4-ft. cubes are then assembled and picked up by lift trucks and placed in storage, two or three cubes high, in the yard, which is paved and flood-lighted for night operation. The yard is marked off in areas to segregate different types and sizes, numbering about 30, and a special stone-saw is available for adapting units to meet unusual requirements.

Transportation of masonry units to construction sites is handled by a fleet of trucks maintained by the corporation. A truck and trailer unit has a capacity of 23 tons, sufficient to fill the entire requirement of a small house.

The ambitious and far-reaching program adopted by Wailes-Bageman, Inc., in the concrete products field has necessitated similarly broad-range plans and arrangements for marketing to keep pace with the volume potential. Accordingly, an arrangement has been made by which Consolidated Rock Products Co. has become the distributor and sales agent for W-B products. This provides utilization of the facilities of a major concrete material organization possessing a large and experienced staff and having a chain of strategically located distribution yards covering the entire Los Angeles metropolitan trading area, and extending into Orange County. Eighteen such yards will serve as display points and will stock W-B products for off-job service, pick-up sale and local delivery.

Wailes-Bageman, Inc., in the construction of this plant, designed, fabricated and constructed its own buildings. It also has available its own experienced construction engineers and superintendents to act in an advisory capacity.

The organization of Wailes-Bageman, Inc., is headed by Chas. D. Wailes, Jr., chairman of the board of directors, and Fred J. Bageman, president. Mr. Wailes was for several years District Structural Engineer for the Portland Cement Association in Los Angeles, and has wide experience in concrete construction, building regulation, civil, structural and consulting engineering. Mr. Bageman has had extensive experience in building contracting, and has had great success in the development of equipment and methods for special applications in the prefabrication of concrete. Geo. W. Trammell is secretary and W. A. Cameron is treasurer. Other key men are E. A. Holland, superintendent of products plant, and R. E. McMeen, plant engineer.

Extensive yard stockpile area with block arranged in cubes for ease in handling. Note lift truck in foreground and truck being loaded in background

Make PRECAST CONCRETE Strong, Dense and Impermeable

By M. W. LOVING*

A PRECAST CONCRETE UNIT is just as strong and durable as you make it and when and if the concrete is defective or fails, in whole or in part under normal service conditions, it will usually be found on investigation, that it was improperly made at the outset. Considering the vast number of concrete structures that have been built in place or with structural units in this country, costing billions of dollars, the percentage of failures is exceedingly small. But progress is based on failures and they must always be investigated by competent men to avoid repetition. The experienced and successful producers of precast structural units have always avoided the mistakes that caused defects under actual service conditions. Each unit must be properly made if the producer expects to survive and this simple rule applies to any industrial enterprise. A good reputation in any line of business is a priceless asset and must be preserved at all costs and it applies today as it did in the past.

The EDITOR of ROCK PRODUCTS asked me to discuss the practicable aspects of making strong, dense and impermeable concrete—based on experience of those engaged in the manufacture of precast structural units, including concrete and reinforced concrete pipe, reinforced concrete lighting standards, piles, cribbing and floor and roof slabs, bridge slabs, et cetera, and at the same time depict the practical reasons with typical examples, which account for the progress that has been made in this direction over the past thirty or more years. It will be seen that the procedure has been based, to a large extent, on the premise so ably set forth in the following editorial in *Engineering News-Record* for January 14, 1932, which is the best estimate of the situation we have ever read:

"Good concrete may be assured by the conscientious application of a few simple rules. This fact becomes increasingly evident as surveys are completed of concrete structures in service over a period of years. Those structures upon which these rules—largely matters of common sense and not intricate formula—have not been violated show up exceedingly well. The famous Tunkhannock viaduct of the Lackawanna Railroad, the largest concrete railroad bridge in the world, has recently undergone a thorough inspection after 17 years of service. Windblown water had caused some discoloration, and imperfect expansion facilities in the parapet resulted in some cracking, but otherwise the 165,000 cu. yd. of concrete in its ten 180-ft. spans is in perfect condition inside and out. Searching for some explanation of this sound condition, one finds only that the mix was not uncommonly rich (1:2:4 for the floor and 1:3:5 for the remainder), that the aggregate were clean and sound, that the mix was as dry as it could conveniently be placed, that thorough mixing was mandatory and that every placement was carefully rodded and tamped. Quite similar factors were held to account for the sound concrete in structures examined several years ago by a committee of the American Concrete Institute. Conversely, the poor quality of other concrete in most cases was attributed to violation of one or more of the above-mentioned simple rules. These inspections of structures in service are providing the concrete art with a much needed background. They should drive home the fact that, regardless of the refinements in strength and density to be obtained through the application of modern discoveries in aggregate proportioning and mix design, the production of durable concrete still rests on a few simple rules, conscientiously and sensibly applied."

*Consulting Engineer

Fig. 4: Prestcrete floor and roof slabs for the Gardner General Hospital Warehouse, Veterans' Administration, Chicago, Ill. More than 17,000 sq. ft. were used on the project in 1945. The units are made on a pipe machine with concrete of uniform strength exceeding 5000 p.s.i. in compression

Selection of Aggregates Important

Selection of fine and coarse aggregate of suitable quality to make good concrete — dense and impermeable — is no difficult problem today. Most of the state highway departments have laboratories, staffed with experienced technicians, who can or already have determined the fitness of aggregate from any source within the various states. Moreover, before aggregates can be used for concrete structures on state highway projects in many states the producers must have their properties qualified as an "approved source of supply" by the materials engineer. Standard specifications for fine and coarse aggregates have been developed and approved by committees of the American Society for Testing Materials, the American Association of State Highway officials and the American Railway Engineering Association —to mention a few. Thus if aggregates of inferior quality are used today for making concrete the producer has no one to blame but himself.

One example, which illustrates the importance of the foregoing suggestions, is the case of reinforced concrete culvert pipe in the State of New York. For more than 15 years reinforced concrete culvert pipe of excellent quality has been produced by experienced manufacturers in New York and it has been used almost exclusively for building highway drainage structures by the State Department of Public Works. The pipe has been tested at regular and frequent intervals by the materials engineer of Albany and at the plants of the manufacturers throughout the state. Test results have been uniformly high, some of the best we have seen any-

where, and the highway officials are highly pleased with the quality of the pipe, its excellent performance in service and the cordial cooperation they receive from the manufacturers.

Yet in 1924 the Director of the Department of Public Works, on the unanimous advice of the district engineers throughout the state, had decided to delete reinforced concrete culvert pipe from the specifications for use on State Highway projects! Their action, based on their experience with reinforced concrete pipe of inferior quality produced in the State was justified and the principal cause of the trouble was the use of fine and coarse aggregate of inferior quality. When the writer arrived in Albany in 1924, it was suggested and agreed that the engineer of tests and the writer inspect the concrete pipe plants throughout the State to determine the cause of this trouble. In most cases bank-run aggregates were used, no attempt was even made to separate the fine and coarse aggregates and grade them properly. In a number of cases the aggregates were extremely dirty and lumps of clay and other foreign matter was used to make the "concrete." Little if any attention was paid to the proper time of mixing concrete. Accurate placement of steel reinforcement and curing was, for all practical purposes, neglected. A provision of the State Specifications for Reinforced Concrete Culvert Pipe required the manufacturers to provide testing machines at their plants so state inspectors could test pipe at frequent intervals. On our inspection in 1924 the few testing machines we saw had not been used and in many cases were covered with rolls of steel reinforcement, old pipe, etc.

The State Highway Department paid about $400,000 more for cast iron culvert pipe, shipped in from out of state sources, compared with the cost of reinforced concrete pipe, had it been used. The cost of cast iron pipe, plus freight, was considered expedient over and above the cost of reinforced concrete culvert pipe. One manufacturer wrote the Governor of New York protesting this "unwarranted action" by the Department of Public Works, claiming among other things, "discrimination against state industries." The late Franklin D. Roosevelt then Governor of New York, answered this letter and enclosed a report from Frederick Stewart Greene, superintendent of Public Works, dated July 24, 1930, from which the following is quoted:

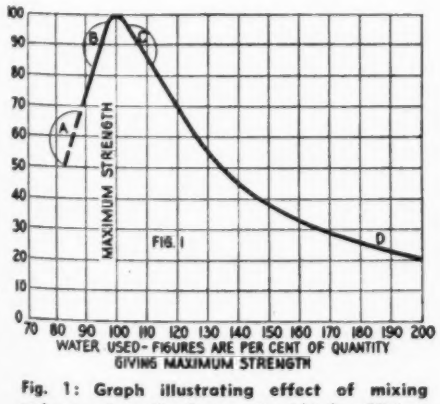


Fig. 1: Graph illustrating effect of mixing water on strength of concrete. (A) Insufficient amount of mixing water to hydrate cement. (B) Semi-dry consistency for machine-compacted concrete of high strength and durability. (C) Plastic consistency for concrete of high strength and durability. (D) With the "Sloppy" concrete mixtures 66 to 70 per cent of the possible strength of the concrete is lost

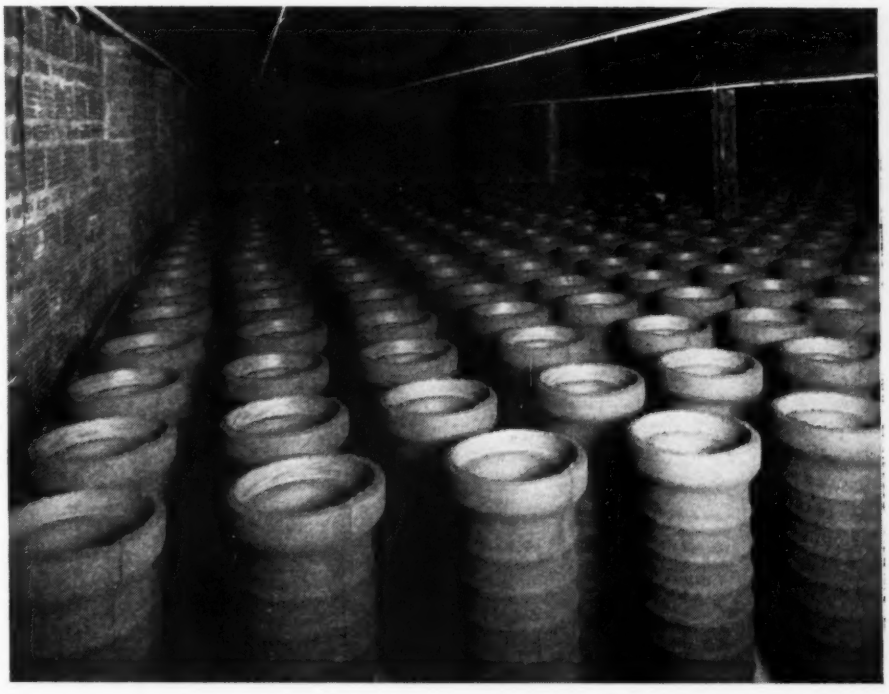


Fig. 2: Typical curing room for concrete pipe, Concrete Pipe Limited, Toronto, Ontario, Canada. Pipe are cured with steam in the winter months and water spray in the summer when temperatures are high. Water or steam is applied as soon as possible after the pipe are placed in the curing room

"If concrete pipe were as good as cast iron pipe, we would use it exclusively, as it costs about one dollar a foot less than the cast iron pipe. Our experience with concrete pipe, however, has not been satisfactory, as we have had a number of failures, not only in the distant past, but in the very recent past. Only last fall District Engineer Brownell, who has been against the use of concrete pipe because of past failures, recommended its use on one of his new contracts. The pipe was furnished by a company which has a good if not a better reputation than any other concrete pipe manufacturer in the State. This spring Mr. Brownell reported that he could pick some of the pipe apart with his hands, and that he will not take the responsibility of using concrete pipe on future contracts. . . .

"Concrete pipe is subject to several causes for failure. In the first place, if not carefully manufactured and cured, it quickly develops imperfections. As it must be laid in the ground, it is constantly subjected to water, which of course it absorbs, and as the pipe is open at both ends, it is subjected to freezing, and this freezing of a soaked concrete pipe is one of the main reasons for our repeated failures.

"I can see no good reason why the State of New York should continue to spend money for a product which has not given good results in the past, and which at all times is uncertain. We have given concrete pipe more than a fair test, and I and the engineers of this Department are now in favor of excluding it from our specifications."

For more than a hundred years cement mortar has been used for lining and coating cast iron pipe for water supply in cities of New York, New Jersey and most of the New England states. Cement lined cast iron pipe is commercially produced and advertised by the manufacturers for service when the pipe lines are required to convey active waters. Mr. Greene's statement, obviously, is correct insofar as it applies to pipe of inferior quality but not to concrete pipe of standard quality. Most of the trunk line railroads in New York state and throughout New England have used reinforced concrete pipe for constructing culverts and other drainage structures since 1910.

Profit by New York's Experience

It took a lot of hard work, over a period of eight years, on the part of the concrete pipe manufacturers in New York to straighten out this unfortunate condition. Meetings with the State Highway Engineer and his

Fig. 5: More than 40,000 sq. ft. of Prestcrete concrete roof slabs were installed in 1946 in the Women's Dormitory, Beloit College, Beloit, Illinois. This is a construction view of that project

subordinate were held at frequent intervals and at first the solution looked hopeless but when the manufacturers honestly agreed to place their house in order and produce reinforced concrete culvert pipe of standard quality and the Department of Public Works agreed to test pipe rigidly and at frequent intervals, the matter was satisfactorily adjusted. A lot of business was lost during the transition from the production of pipe of very poor quality in 1924 to about 1932 when the manufacturers and the Department of Public Works got going on the excellent pipe that has been made to the present day. The lesson had to be learned the hard way. Moreover, an irresponsible manufacturer cannot do business with the New York State Department of Public Works today and that is fair to everyone.

Proper Mixing Essential

Thorough mixing of concrete is of major importance and sufficient time for this operation should always be provided. In other words, mixers of adequate capacity must be used so workmen do not have to neglect the time element to meet production schedules. Timing devices should be installed on mixers so the operators do not have to guess; there is no valid reason why an operator should be required to guess how long concrete should be mixed. On many occasions I have asked plant superintendents and foremen how long they were mixing concrete and was told "four or five minutes" and when I timed the operators the concrete was mixed less than one minute.

Moreover, clearing devices should be installed in mixers so each batch is completely discharged. Otherwise lumps of concrete, mixed in the early morning, may be used in concrete units and structures several hours later. This is "dead" or what is technically known as "retempered concrete" and accounts for structural defects later in service.

All conveyors, from mixer to machine, should discharge freshly mixed concrete continuously and under no circumstances should dead concrete be allowed to accumulate or be used in the manufacture of any unit. Always remember what Mr. Greene told Mr. Roosevelt about culvert pipe of inferior quality in July, 1930. Improperly mixed concrete or retempered concrete accounts in a large measure for irratic test results and especially defective concrete in part of a structure which may be surrounded by sound, dense concrete — properly mixed. When part of a concrete unit or structure is in good condition and defective concrete is observed in the same structure, subjected to the same conditions of normal service, the chances are that retempered (dead) concrete is responsible for the defects. Or else, too much calcium chloride was used in an effort to expedite hardening and production. When workmen knock off for the noon hour or when machines break down, requiring time for repairs, the concrete in the mixer and conveyors should not, under any circumstances be used if it has been mixed more than one hour. Experienced and responsible manufacturers use such concrete for making units that may be sold as seconds for use in places where partial failure or defects is of secondary importance. They are too sensible to risk their reputations by using concrete they know is defective. As the old saying goes "it's all right to kid a fellow but bad business to kid yourself!"

In many cases, and on important projects, which I have investigated, engineers are willing to accept the alibi that the defects in concrete work were due to improperly mixed concrete, dirty aggregates, retempered concrete and what have you. But they usually come back with this typical question and answer: "How do we know that the same defects, for the same reasons, will not occur again? We cannot afford to take chances!" Remember what Mr. Greene told Mr. Roosevelt in 1930 and how the responsible manufacturers set their house in order and got back in the good graces of the engineers of the Department of Public Works, State of New York!

When concrete of semi-dry consistencies is employed, experienced manufacturers find it expedient to dry-mix the cement, fine and coarse aggregates, for at least two minutes to assure uniform dispersion of the cement throughout the batch. This is very important. Then water is added and the concrete is mixed for two or more minutes. With plastic mixes, an abundance of water is used to assure proper hydration of the cement and dry mixing is not so important. But concrete of plastic consistencies, too, must be thoroughly mixed for two or more minutes.

Check Water Quantity Carefully

The quantity of water required for mixing concrete of semi-dry consistency is of major importance, if too much water is used the unit—when the forms are immediately stripped—will slump out of shape. If an insufficient quantity of water is used, to assure proper hydration of the cement, the distinct web-like markings on the surface of the units when the forms are immediately stripped will be conspicuous by their absence. The complete absence of these markings on concrete pipe, made by the machine-tamped or packer-head processes, is a cause for rejection under the Standard Specifications of the American Society for Testing Materials and the American Association of State Highway Officials. The same requirements are or should be mandatory in Standard Specifications for other concrete units made with concrete of semi-dry consistencies. The basic reason for this can be appreciated by studying Fig. 1 and its caption published by Duff A. Abrams* in 1917.

Because it is easy to strip forms when the concrete is too dry, workmen naturally prefer it. Plant superintendents and foremen want to expedite production to please the owners.

*Formerly Professor, Structural Materials Research Laboratory, Lewis Institute, (now Illinois Institute of Technology) Chicago.

But the dangers and the risks are too great to warrant this fatal mistake for the following practical reasons:

Prior to 1920 few reputable engineers would specify or use concrete units made with concrete of semi-dry consistencies. Reason? A large per cent of the units failed, in whole or in part, under normal service conditions and had to be replaced at great expense and inconvenience. On many occasions I have examined these units, had the soil and soil waters in which they were installed analyzed, and found the cement mortar, of plastic consistency used to join the units was in excellent condition and mortar used to patch defective workmanship also in sound condition. But the units, made with dry concrete, were often completely disintegrated. The analyses of soil and soil waters proved that there was nothing to disintegrate sound concrete; the sound condition of the mortar used for joints and patching installed at the same time proved that there were no conditions existing that would affect good concrete. The too-dry, semi-dry concrete failed because the cement was not properly hydrated. This is the basic reason why the maximum amount of water must be used in concrete of semi-dry consistency—when forms are immediately stripped — to assure a long life expectancy. This is old stuff to experienced, reputable manufacturers but it should serve as a warning to the uninitiated.

From Fig. 1 and its caption it will be seen that with plastic concrete mixtures the minimum amount of water should be used to produce concrete of maximum strength. But this must not, under any circumstances, be confused with semi-dry concrete mixtures for the reasons shown in Fig. 1 and its caption. The old slogan "concrete improves in strength with age" is as valid today as it ever was, but it applies in a large measure to concrete made on the plastic side of the curve shown in Fig. 1. The so-called "sloppy" concrete mixtures used extensively about 15 years ago ranged in compressive strength from 1500 to 2000 p.s.i. When used underground and not exposed to freezing and thawing conditions this concrete did increase in compressive strength after several years up to 5000 p.s.i. But these low strength concretes frequently failed on exposure and when vibration came into the picture in 1926, the sloppy consistency concrete was not used thereafter by reputable manufacturers. With vibration the harsh, dry, plastic mixtures can be placed in forms economically. Some of the best and most uniform quality concrete has been made by the vibracast process and the tests for compressive strength have usually exceeded 6000 p.s.i. and with special aggregates up to 12000 p.s.i. Moreover the vibracast concrete is very dense and impermeable. Some engineers object to the air bubble texture on the surface of vibracast concrete structures but except for appearance (side walk inspection) the concrete is strong, dense and impermeable. The surface textures can be improved by precision vibration, gradation of aggregates, but air bubble texture cannot always be eliminated. Vibracast reinforced concrete cribbing has withstood alternate freezing and thawing for more than 20 years in middle western and eastern states under the severest service conditions. This was because the concrete was of maximum strength, density and very impermeable.

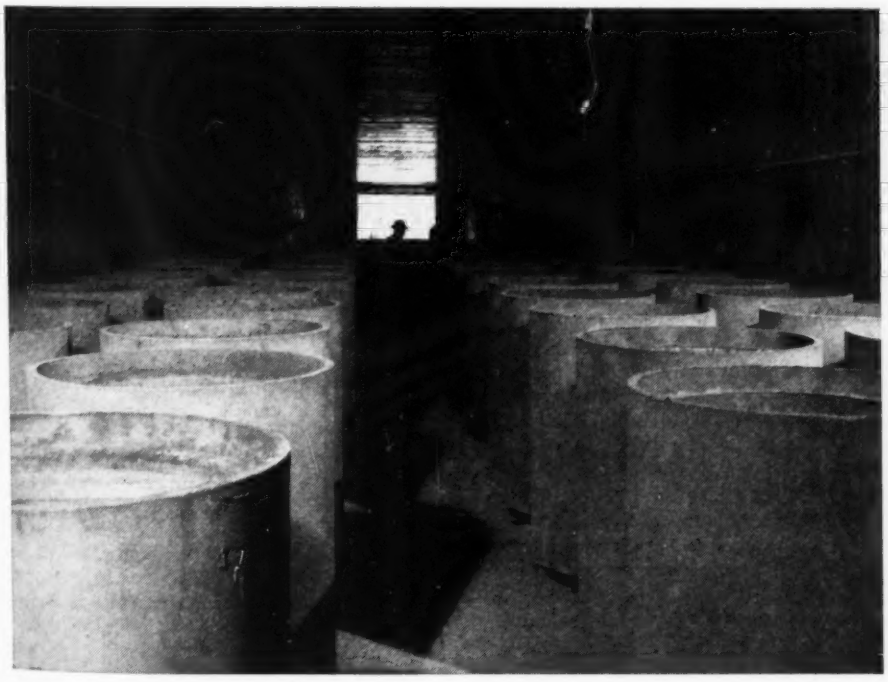


Fig. 3: One of the thirteen curing rooms of the plant of the Illinois-Wisconsin Concrete Pipe Co., South Beloit, Ill. It is 20 ft. in width and 150 ft. long, built with concrete throughout, including the roof, with Prestcrete slabs. Steam curing is used in winter and water spray in summer. This company manufacturers Prestcrete floor and roof slabs, described in ROCK PRODUCTS, August, 1944

Adequate Curing Essential

Adequate curing of concrete with water, steam or a combination of both cannot, under any circumstances, be neglected in the production of sound, dense, high-strength and durable concrete. No matter how much care has been exercised in the selection of aggregates, time of mixing with the proper amount of cement, it is of major importance to cure concrete to avoid structural and other defects and to assure a long life expectancy. Adequate curing prevents the evaporation of mixing water in concrete of semi-dry consistency which is needed to properly hydrate the cement, as previously stated. Proper curing prevents the rapid evaporation of the "free water" in plastic concrete mixtures thus minimizing volume change, including shrinkage cracks and other objectionable defects.

Competent plant superintendents and foremen cannot meet production schedules unless the owner provides adequate space for adequate curing, especially those plants located in cold climates. J. D. Mollendorf, president, Illinois-Wisconsin Concrete Pipe Co., Chicago, told me on December 6, 1946, that he plans to extend and modernize curing facilities at his plant at South Beloit, Ill. More than 25,000 sq. ft. of curing space is now in service there, but he thinks curing is so important that he wants to make the steam curing system of his plant as efficient as possible. In the production of Presterete floor and roof slabs, which is a major portion of his business today, careful curing of each unit is of major importance to assure maximum strength, density and impermeability. This company hs been and is a major producer of concrete pipe, reinforced concrete sewer and culvert pipe and concrete drain tile; also concrete manhole blocks, etc.

At this plant all concrete units, during freezing weather, are cured by steam at a temperature ranging from 70 to 100 deg. F. for 48 to 72 hours and kept constantly moist thereafter for six days. High-early-strength cement is used for making most of the concrete units.

The only advantage of steam curing over water spray is the higher temperature which accelerates hardening of concrete. In the southern climates steam curing is not so necessary because water spray is just as effective provided the units are kept constantly wet, especially for the first 48 hours after they are made.

During the war and even today the demand for some concrete units was and is so great that curing facilities are taxed to the limit. Not infrequent-

(Continued on page 180)

Most Efficient Methods Determined by Tests

William Moors Concrete Products Co., Fraser, Mich., conducts interesting experiments to determine humidity and temperature conditions for most rapid curing and highest strength

By GEO. A. MANSFIELD*

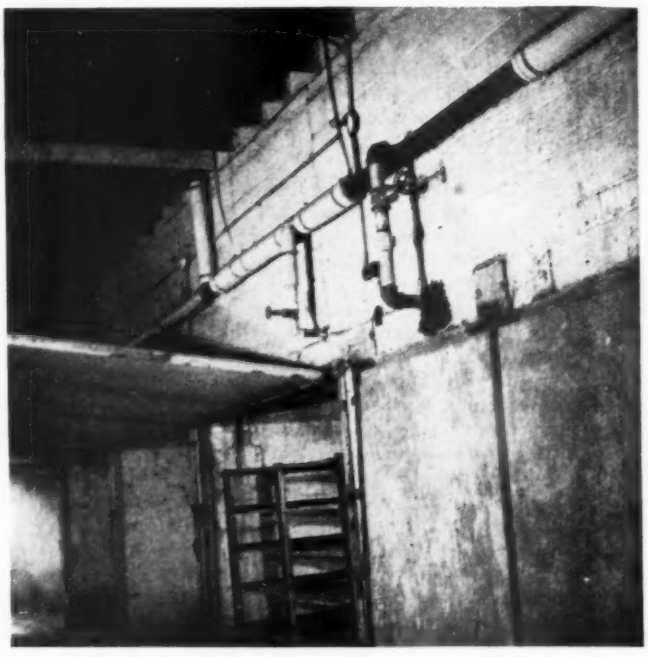


Fig. 1: Front view of 12-rack capacity kilns. Note indicator lights near ceiling, above open door

INCREASING demands for concrete masonry units in the past few years, largely due to the lack of other standard building materials, emphasizes the need for an efficient and rapid method of curing. Because of the predominant position concrete masonry has taken in the construction field, considerable thought has been given by the masonry industry to the retention of this position when all materials become available in large quantities.

Steps to Improve Curing

In the early years of concrete masonry manufacture, the product was usually employed in construction below ground and cracked walls were the generally expected occurrence rather than the exception, but with the acceptance of concrete masonry for architectural beauty and utilitarian construction, concrete masonry construction was brought above ground. Failures due to shrinkage cracks then became subject to view and in many cases caused architects, owners and builders to be wary of this type of construction material, particularly for use in exposed surfaces to be decoratively painted. This wariness is still somewhat apparent in the construction industry and the cause or causes for shrinkage cracks in masonry walls must be eliminated if concrete masonry is to retain its present position as a leading construction material.

The question of the cure for shrinkage failures has been attacked by a number of leaders and authorities on concrete masonry with the result that an A. S. T. M. standard governs the required strength, absorption, and moisture content of each unit. The aggregate quality, gradation and proportioning; the cement factor and the water content have been fairly well determined, and adherence to the established practices assures the conformance of concrete products to the strength and absorption specification requirements if adequately cured. The moisture content of the units, however, at the time of their use in construction has not been given the consideration desired. Naturally the strength and absorption factors are directly related to curing, and by curing is meant that the masonry units are exposed to a 70 deg. F. minimum temperature in an atmosphere essentially at 100 per cent relative humidity.

During the concrete masonry industry's infancy, the units were usually placed in yard storage where the conscientious producer would add moisture by wetting, but in too many cases the application of moisture so necessarily required was left to the whims of nature. Soon thereafter it was observed that if some heat was made available to the units, then an accelerated hardening would be obtained. Subsequent with heating, moisture was added in the form of steam vapor or atomized water and temperatures under this method usually hovered at 100 deg. F. High pressure steam curing proved highly effective for concrete masonry, but the initial high cost of the system and subsequent operating costs made it prohibitive for the average producer. Because heat caused accelerated curing, greater consideration was given to high temperature curing in the range from 120 deg. to 200 deg. F., with the ultimate end being a specification product at the end of 24 to 48 hours. In plants of high production capacity, such a curing system becomes a definite asset as it reduces the need for large stock inventories during peak construction periods.

Thermodynamics of Curing

The high temperature curing problem in the past has been attacked from a heating and humidity standpoint rather than from a processing consideration. From thermodynamics we know that the higher the dry bulb temperature, the greater will be the grains of moisture required per pound of dry air to maintain a condition of 100 per cent relative humidity. For example, we can suppose that a curing system is being employed having a dry bulb temperature of 130 deg. and a wet bulb temperature of 130 deg., which is 100 per cent relative humidity. This atmospheric condition requires 781 grains or 0.1116 lb. of moisture per lb. of dry air. If the dry bulb temperature is raised to 180 deg. without an increase in grains of moisture per lb. of dry air, the wet bulb temperature will be 133.5 deg. with a resultant humidity of 29.7 per cent. (1) Similarly, at 200 deg. dry bulb temperature, the relative humidity would be 19.3 per cent. This physical phenomenon is treated to emphasize the need for a greatly increased moisture content at elevated temperatures. The required amount of moisture per pound of dry air to maintain 100 per cent humidity at 180 deg. and 200 deg. F. is 4,604 grains or 0.658 lb. and 16,065 grains or 2.295 lb., respectively. (2) Whether the atmosphere requires 100 per cent humidity for proper curing of concrete masonry is open to question, but as the concrete units increase in temperature, the vapor pressure of the moisture in the block increases as follows: at 130 deg. the

*Technical Service Director, Huron Portland Cement Co., Detroit, Mich.

vapor pressure is 4.53 in. of mercury or 2.22 lb.; at 180 deg., 15.29 in. or 7.51 lb.; and at 200 deg., 23.47 in. or 11.52 lb., which would indicate that a humidity approaching 100 per cent should be maintained.

From the preceding figures it can be readily seen that the moisture required for the hydration of the cement will be removed from the block due to the vapor pressure regardless of the relative humidity if elevated temperatures are maintained for long periods. Also, when temperatures of 105 deg. C. (221 deg. F.) are maintained, then chemically compounded water is driven from the hydrated cement, which in turn tends to destroy the cement gel, and it is advisable to refrain from using in excess of 200 deg. F. for atmospheric pressure curing. Similarly, when a plant intends to use dry heat for reducing moisture content, then the same caution must be observed to prevent loss of the chemically compounded water.

Another factor that affects the quality of the concrete masonry unit is atmospheric carbonation. As the water content is reduced during drying at successively lower humidities, the rate of absorption of carbon dioxide becomes increasingly rapid. Subsequent with carbonation shrinkage occurs by the formation of calcium carbonate.[3] If the surface drying is more rapid than the interior of the shell and web members, then a differential shrinkage takes place which will cause fine cracks observable at the top of the shell and web walls. Carbonation aids the strength of the concrete but if excessive, even though no cracks are apparent, the concrete units become brittle, are not highly resistant to shock and are of a lower durability factor.

Plant Layout and Equipment Where Curing Studies Were Made

At the William Moors Concrete Products Co. in Fraser, Mich., located a few miles northeast of Detroit, certain considerations were established before a curing method was finally adopted; namely,

1) Masonry units are to meet A.S.T.M. specification requirements for compressive strength and absorption, within a maximum of 48 hours from time of manufacture;
2) Moisture content below 40 per cent at time of delivery of masonry units, and
3) Masonry units to be resistant to shock during all stages of handling following curing, and be of high durability.

The plant manufactures both cinder block and concrete block at a yield of 22 and 27 blocks, respectively, per sack of air-entraining cement. The cinders are received from the Detroit Edison power plant and crushed at the William Moors plant by a primary hammer mill, with the oversize screened out and oversize passed through a secondary set of crusher rolls. Experiments on crushing were conducted to obtain the most suitable gradation for strength and texture and only crusher run cinders are used. The following is the gradation finally established as most suitable:

Sieve Size	½-in.	⅜-in.	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100
% Passing....	100	98.7	75.2	48.3	28.8	18.1	10.7	6.0

Fineness Modulus 4.14

Sand and gravel are received from nearby local gravel deposits and combined in the yard to the following gradation which is most suitable for the materials available:

Sieve Size	⅜-in.	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100
% Passing	100	80	59	50	42	15	2

Fineness Modulus 3.52

Bulk cement and aggregates are stored in overhead bins from which volumetrical batching is made in a converted Eberling continuous mixer. The flow of materials into the mixer is so regulated that the flow of concrete into block machine is consistent with the demand for concrete by the block machine, resulting in a constant head of concrete in the hopper. The blocks are made on a Besser Vibrapac, air off-beared to 72-block capacity racks, and the racks carried by power lift trucks to kilns holding 12 racks.

Conditions of Curing Tests

The blocks had to pass through a pre-setting stage which was determined as a minimum of 30 min. for the cinder units, and 2 hr. for the concrete units. The steam is turned on following the pre-setting period, and enters the kiln through a stub of 1¼ in. dia. pipe set at the center of the doorway at the kiln ceiling. It was determined that approximately 1½ hr. of steaming were necessary for most efficient curing, but the period varied according to atmospheric temperatures as more steaming is necessary during the colder months. This completed the steaming cycle and the blocks then remained in the kiln with the door remaining tightly closed until yarding, which is called the soaking period. Before opening the door, the air is circulated by a blower giving 2½ air changes per minute within the kiln. The duct and blower system (Fig. 1) is so designed that one blower can circulate the air in any individual kiln, transfer air from one kiln to another, or exhaust kiln air to the atmosphere. All the duct work and blower is non-insulated and treated to prevent corrosion by the moist laden air. During circulation of the air, moisture in the warmer air, being revolved, is deposited on the cooler interior surfaces of the duct and the condensate permitted to drain off at the blower, and in this way some reduction in moisture content of the block is accomplished. The entire curing period from the time the door is closed until opened for yarding covers 15 hours. A typical test run on concrete blocks cured as described above resulted in the strengths contained in Table I, shown on page 156.

The 28-hr. specimens represent 28 hr. from the time the block were

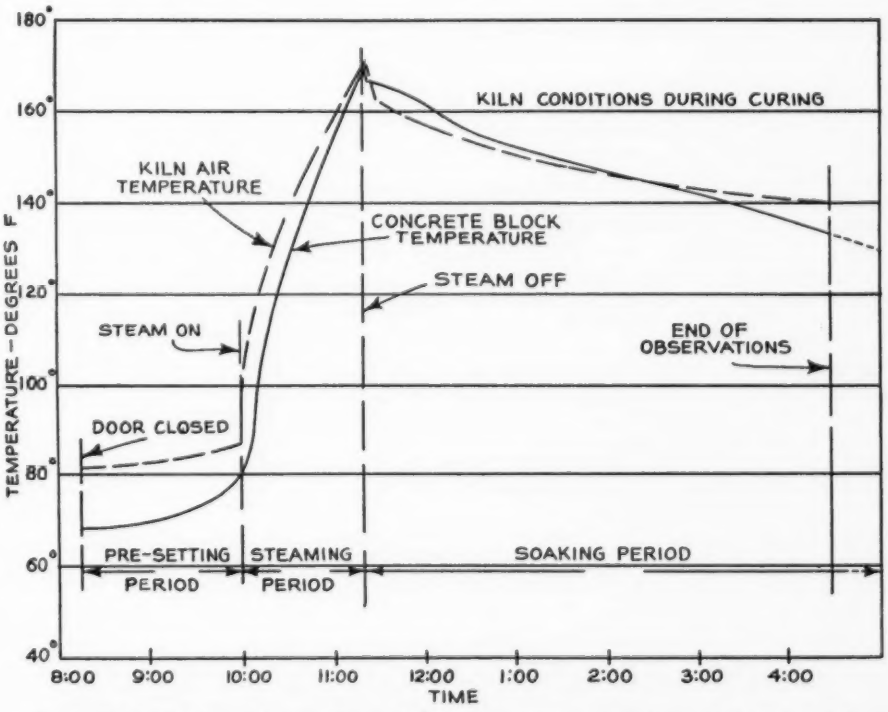


Fig. 2: Graph showing curing conditions during the presetting, steaming and soaking periods

TABLE I: TYPICAL STRENGTH RESULTS FOR LIVE STEAM CURING

Age Tested	Specimen	Strength—Lbs. per Sq. In. Gross Area
28 hours	1—1	1420
	1—4	1279
	1—6	1285
	Average	1328
7 days	1—1	1695
	1—4	1559
	1—6	1938
	Average	1731
28 days	1—1	1714
	1—4	1700
	1—6	1911
	Average	1775

Note: Specimens 1—1 represent samples taken from the top pallet of the rack; 1—4 represent samples from the fourth pallet from the top; 1—6 represent samples from the bottom pallet of the rack.

manufactured until the moment they were tested. The tests were cooperatively conducted by the William Moors Concrete Products Co., Concrete Curing Corporation of Detroit, Mich., and the Huron Portland Cement Co. Testing of the specimens was performed by the City of Detroit Building Department and the results are completely reliable. The 7-day strengths are a gain of 30 per cent over the 28 hr. results, but the 28-day gain is only 33.7 per cent, indicating that storage over seven days under this method of curing is not warranted for additional strength. It is highly probable that a considerable per cent of the strength gain may have developed prior to the 7-day period, but until tests are conducted on intermediate ages between 28 hrs. and 7 days this can only be a matter of conjecture. All of the tests were made on 8 x 8 x 16 in. regular units and the William Moors plant being a one machine plant, the opportunity was not always present to perform continuous tests.

One question that arose from studies at plants using other methods of applying heat and moisture related to the evaluation of 140 deg. F., 170 deg. F., and 200 deg. F. temperatures, particularly when the kiln is brought up to the desired temperature and then held at that temperature for a pre-determined period of time by intermittent injection of steam. A comparative study was made of five methods of applying steam under closely regulated plant operations by selecting five kilns at the William Moors plant, each having a different application of steam. Each of the kilns has an indicator light (Fig. 1) which is controlled by a thermocouple that can be set for any desired temperature. Test specimens were taken from each kiln from a rack identically located in each kiln and from the same positions on the rack as described in above tests (Table I). Kiln No. 2 held the units previously discussed in which steam was turned on until a temperature of 170 deg. was reached and steam turned off; kiln No. 1 had steam on until 199 deg. temperature was reached when steam was turned off; kiln No. 3 had steam turned on until 170 deg. was reached and intermittently turned off and on to hold 170 deg. for entire curing period; kiln No. 4, same as kiln No. 3 except temperature of 140 deg. was maintained. Kiln No. 5 had steam on until 140 deg. was reached when it was turned off. Table II contains the comparative strengths for the various methods of steam application.

TABLE II: COMPARATIVE STUDY OF STEAM APPLICATION METHODS

Kiln Number		1	2	3	4	5
Degrees		199	170	170	140	140
Door Closed		11:10 a.m.	9:15 a.m.	11:30 a.m.	2.00 p.m.	8:45 a.m.
Steam On		1:00 p.m.	11.35 a.m.	2:30 p.m.	4:00 p.m.	11:00 a.m.
Steam Off		2:30 p.m.	1:00 p.m.	2:30 a.m.	3:00 a.m.	11:35 a.m.
		COMPRESSIVE STRENGTH				
28 hours	1—1	866	1420	692	413	916
	1—4	821	1279	573	463	849
	1—6	681	1285	531	390	560
	Average	789	1328	599	422	775
7 days	1—1	1015	1695	1033	741	1366
	1—4	1162	1559	768	629	1248
	1—6	1149	1938	797	803	1309
	Average	1109	1731	866	724	1308
28 days	1—1	—	1714	1191	821	1465
	1—4	—	1700	1100	966	1454
	1—6	—	1911	989	1024	1420
	Average	—*	1775	1093	937	1446

*The 28-day specimens for Kiln No. 1 were lost by inadvertently being placed in yard storage.

Test Results

A casual examination of the above test results prove beyond a doubt that the method used in kiln No. 2 is far superior to the other methods, followed by the methods somewhat similar in steam application. Naturally, it is quite disturbing to observe strength results for concrete block cured under 199 deg. temperature to be 41 per cent and 36 per cent less for the 28 hr. and 7-day results, respectively, of masonry units cured under 170 deg. (kiln No. 2) temperature, while the results of the 140 deg. (kiln No. 5) temperature curing are 98 per cent and 118 per cent of the 199 degree tests for 28-hr. and 7-day ages, respectively. Temperature observations within the blocks and the kiln air during a curing cycle indicate an answer for this apparent non-conformity to a logically assumed development in strength. Such observations were made with six thermocouples installed in a kiln and connected to a potentiometer recording directly in degrees of temperature. A quick change switch was used so that all six readings could be taken within 60 seconds. Thermocouples were placed in the kiln as follows: No. 1, in the shell of a block on the top pallet; No. 2, in the shell of a block on the fourth pallet; No. 3, in the shell of a block on the sixth or bottom pallet; No. 4, kiln air at the ceiling; No. 5, kiln air midway between the ceiling and the floor; No. 6, kiln air at the floor. An assembly was also arranged whereby a pallet of three blocks could be weighed during the curing cycle coincident with the temperature readings. This was provided by placing a platform scale, accurate to 0.01 lb., on the roof of the kiln with a chain connected to an attachment on the scale platform and the chain inserted through a small hole in the roof of the kiln, with the bottom end of the chain fastened to a hanger that held the pallet with the three block suspended midway between the ceiling and the floor. The results observed for the intermittent readings of the six thermocouple temperatures and scale weight are shown in Table III.

The steam was turned on at 10:00 a.m. and turned off at 11:20 a.m., giving a 1 hr. 20 min. steaming period. It had been predetermined that the steam should be turned off when the temperatures of the air in the kiln and the temperatures within the concrete block shells approached equalization of temperature. This length of time for steaming was established

TABLE III: KILN CONDITIONS DURING CURING CYCLE

	Thermocouple Temperature						Suspended Weight	
Time	1	2	3	4	5	6	Assembly	Net Change Per Block
8:15 a.m.	72	68	69	97	82	79	187.62	—
10:00	97	79	77	99	87	81	187.50	—0.04
10:15	114	109	114	125	123	122	188.59	+0.32
10:30	130	128	134	137	134	135	189.34	+0.57
10:45	142	142	144	149	147	147	189.75	+0.71
11:00	155	154	156	159	157	157	190.38	+0.92
11:15	164	164	165	168	167	167	190.87	+1.08
11:20	170	170	169	171	170	170	191.01	+1.13
11:21	167	166	163	168	165	162	191.01	+1.13
11:25	168	166	155	164	163	153	191.01	+1.08
11:30	168	166	151	164	162	147	190.85	+1.04
12:00	163	162	136	161	157	132	190.75	+1.04
12:30 p.m.	159	156	132	157	154	125	190.75	+1.04
1:00	155	153	127	154	150	122	190.75	+1.04
1:30	155	150	127	152	148	119	190.75	+1.04
2:00	154	147	127	153	147	119	190.75	+1.04
2:30	152	144	126	150	144	119	190.75	+1.04
3:00	149	142	124	148	143	118	190.75	+1.04
4:30	146	134	118	143	140	118	190.75	+1.04

from the theory that the concrete masonry units would take on moisture when they are cooler than the dew-point temperature of the surrounding kiln air, and they will lose moisture at equal temperatures due to the vapor pressure. The assembly suspended weight bears out this theory as the weight increase diminishes as the temperatures reach stability. This point of equal temperatures is called the point of equilibrium.

The steaming cycle is only one phase of curing under this method because the soaking period is also a definite factor for hydration of the cement products. As the temperature in the kiln decreases, the relative humidity increases because the moisture in the kiln remains relatively constant. Therefore, as long as the air temperature within the kiln is above 70 deg., the condition within the kiln is favorable for accelerated curing in a highly humid atmosphere and the moisture is not removed from the masonry units which is necessary for hydration. When the temperature within the kiln is brought beyond the point of equilibrium, then moisture is removed from the concrete, which places the concrete units in a condition unfavorable for hydration, even though the atmosphere be of a high humidity, because this moisture so essential for hydration is not replenished during the soaking period.

The temperatures are graphically described for the concrete block (thermocouple No. 2) and the kiln air (thermocouple No. 5) in Fig. 2. This figure shows the curing conditions during the pre-setting, steaming and soaking periods.

No definite conclusions were established from the specimens of kilns No. 3 and No. 4 (Table II) wherein strengths developed were far below strengths of the specimens from the companion kilns No. 2 and No. 5. The former had temperatures brought up to and held at 170 deg. F. and 140 deg. F., respectively, whereas the latter were brought up to the same temperatures followed by soaking periods. The time of exposure of the blocks within the kilns was practically 15 hr. for all the kilns from the time the doors were closed until finally opened. It was observed, however, that the specimens from kilns No. 3 and No. 4 at the time of sampling were completely saturated with water.

On the basis of these and other tests it was determined that a 170 deg. F. temperature maximum was best suited for the facilities at William Moors Concrete Products Co. when running concrete block and 180 deg. F. for cinder block. It is hoped to establish a slightly higher equilibrium temperature, or shorter steaming period, after a few changes are made in the steam lines from the boiler. The boiler is 70 hp., carrying 12 to 15 lb. pressure and taking water preheated to 180 deg. to 200 deg. from a 10-hp. hot water boiler. The combination provides a uniform steam exhaust into the kiln and sufficient steam for steaming one kiln at a time, but as each kiln requires approximately 1½ hr. of steaming, which is slightly more than time required to charge the kilns, no confusion in plant operations was encountered.

The two original kilns at William Moors held approximately 3,200 units and were cured with radiation and moisture injected with steam nozzles. Live steam through an open pipe was tried with results far superior to the original method but not as effective as desired. Five kilns were then erected of 12-rack capacity in which the tests described were conducted. The original application of steam was not entirely satisfactory but the condition was corrected by the Concrete Curing Corporation following which the detailed tests herein described were conducted. The kilns are 8 ft. wide, 7 ft. high, and 45 ft. long, with a 5-in. cinder concrete roof overlaid with Celotex sheathing and built-up roofing. The original kilns are being subdivided to hold 20 racks, each, which will make a total of nine kilns having a combined capacity of approximately 10,000 block.

Plant operations are so performed that the masonry units stand two hours before steam is turned on but it was thought that permitting the blocks to set longer might give better final results. A test run was made on cinder block for two, three, four and five-hour settings with following results for two-day age:

	Specimen			
Setting Time	1	4	6	Average
2 hour	942	906	878	909
3 hour	819	848	1059	909
4 hour	880	878	920	893
5 hour	865	835	887	862

These results indicate that no advantage is gained by prolonging the setting period for cinder blocks. Usually the strengths on cinder block are quite erratic and as these specimens represent approximately a half day's production, the test at least indicates uniformity of aggregates and mixing. Similar tests will be conducted on concrete block as there may be an advantage to prolonged pre-setting because of the concrete block being more dense than cinder block.

Concrete blocks taken directly from the racks after removal from the kilns were *immediately weighed for determination of absorption and moisture content.* It has been observed by test that masonry units lose considerable moisture from the time they are removed from the kilns until placed in yard storage. Very little time elapsed between removal from kilns to weighing because the maximum moisture content was desired on specimens having a minimum period of drying. A series of eight test samples gave the following results:

Specimen:	1	2	3	4	5	6	7	8
Absorption lbs./cu. ft.	9.59	8.62	8.08	7.84	7.31	7.24	7.1	7.1
Moisture Content %	51	55	45	67	54	55	57	60
Moisture lbs./cu. ft.	4.89	4.64	4.04	5.25	3.94	3.98	4.05	4.26

The absorption determinations are definitely within the specification limits whereas the moisture content percentages are above the maximum requirements. No particular drying was attempted by the duct system except removal of the steam and heat to permit entry into the kilns, but it will be possible to reduce the moisture content to below specification requirements when all the kiln construction is completed to permit a longer curing cycle. This brings up a point of conjecture regarding the specification that appears to need attention, and that is: Is the moisture content as expressed by the current specifications a true measure of the condition desired in a concrete masonry unit? It seems that the producer of the higher quality product is unnecessarily penalized because the above results show a trend toward higher moisture content for the lower absorption tests. This is understandable as the more dense the concrete unit, the more difficult it will be to remove the moisture because of the smaller capillaries present. For example, a producer could market a product at 15 lbs. per cu. ft. absorption and meet 40 per cent moisture content but actually the unit would have an absorbed moisture of 6 lbs. per cu. ft., which is higher than the worst condition obtained in the preceding tests. It would seem then that the amount of water contained in the unit would be the factor controlling shrinkage rather than the per cent moisture content. In fact, a specification limiting moisture to 4.5 lbs. per cu. ft., which is equivalent to 30 per cent moisture content as per specifications, would be more practical, and if such a requirement were incorporated the above specimens would meet the specifications for two exceptions, the very ones that are more favorable under present specifications.

The curing system herein described is primarily designed to entail 24 hr. for charging the kiln, pre-setting, steaming, soaking, drying, and discharging the kiln. With the addition of the reconstructed kilns, this cycle will be adhered to and improved strengths, absorption and particularly moisture content should result. Detailed studies on drying and measurement of drying shrinkage are contemplated, but these studies will not be entered into until the weather becomes more favorable and all the kilns are in operation.

To describe a general detailed procedure and facilities for the curing of concrete block would be a fallacy, because each plant differs as to kiln

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The DESIGN of Concrete Mixes

Part 3—Operations Preliminary to Design for Economy

By R. E. ROBB*

PRECEDING articles of this series on scientific control of concrete manufacture have dealt respectively with: the importance of specific gravity in concrete control; the importance of grading in concrete control, with the development of the philosophy of concrete proportioning; the necessary operations preliminary to designing concrete mixtures to meet specifications as regards quality of the finished product. This article is concerned primarily with the determinations necessary in order to keep to the minimum the cost of a mixture which fully meets specifications.

Aggregate Control

It was shown previously that, "If smaller aggregate is used in a concrete mix than could have been used and still obtain satisfactory placement, the absolute volume of the aggregate in the concrete is decreased and the amount of cement required is increased." Stated slightly differently, "Using smaller aggregate of the various sizes available than could have been used and still meet placement requirements wastes cement and increases costs." Since the grading of the aggregate determines costs, and therefore profits, it is essential that the grading of all sizes of aggregate used be under close control at all times. This can be secured only if segregation is eliminated.

Segregation, which is practically unavoidable when aggregate having a wide range in size of particles is handled, is caused by the difference in the potential and kinetic energy of the particles. If two particles of different size but of the same specific gravity are held at rest above a point, they have different amounts of potential energy, depending on their respective weights. If these two particles are dropped, the potential energy is transformed into kinetic energy and when they strike, the larger, having more kinetic energy, will bounce farther or roll farther than the smaller. This is the basic reason for segregation when aggregate is handled. It applies particularly and almost exclusively to coarse aggregate. It is true that sand has different sizes of particles, but another factor comes into play with sand; viz., the surface tension of the water carried by the sand. Dry sand will segregate to a certain extent, but because all of the particles are relatively small, even this is not serious.

But sand used in concrete is practically always damp. This effectively prevents segregation to any appreciable extent. It can usually be disregarded.

The obvious remedy for segregation in coarse aggregate is to reduce the variation in size of particles handled at one time to the point where the particles will be so nearly the same size that the differences in kinetic energy will be negligible. Then segregation is impossible.

Preventing Segregation

Fig. 1 illustrates what happens when aggregate passing 1½-in. openings and retained on screen with 3/16-in. openings (No. 4, the division between sand and coarse aggregate) is chuted into a square hopper bin from a bucket elevator at one corner of the bin, the typical multi-bin aggregate hopper. When the large particles hit the deflecting chute they bounce, whereas the smaller ones merely slide down the chute and drop vertically into the bin. The larger ones build up faster in the bin than the smaller and eventually roll back on the smaller until the latter catch up. The result is that the aggregate is deposited in the bin in irregular layers of different sizes. When drawn off from the gate at the bottom, and often at one corner, of the bin, there is inevitably wide variation in the grading from batch to batch. The result is that no matter how carefully the total weights of all ingredients are watched, and no matter how careful the compensation for moisture, there will be wide differences in the batches of concrete and it will be necessary to add more water in some cases to make the mix workable. This destroys all semblance of control, from the standpoint of both quality and economy.

This phenomenon was called to the writer's attention most forcibly some years ago when supervising the batching, mixing and delivery of concrete for the invert of a large Imhoff sewage disposal tank. The engineer in charge of construction had specified the proportions of the various sizes of aggregate and had very carefully checked the loading of every car at the gravel plant. Fully automatic weighing equipment, with automatic compensation for surface moisture, was used, and competent technicians made moisture determinations, with corresponding compensations, for practically every batch. Also, a graphical record showed the weight of every ingredient in every batch. It was thus known positively that the total weights of coarse aggregate, sand, cement, and water were identical for every batch within extremely close limits. Yet it was found that some batches from the transit mixers were too wet while others were so dry that a large amount of water had to be added to make them workable. It was noted that the wet batches looked to be coarse, while the dry ones were usually composed chiefly of small particles. Observation of the aggregate as it went into the bin showed that almost complete segregation was taking place, as shown in Fig. 1.

The solution of the problem was absurdly simple. The aggregate was sized at the gravel plant into 1½-in.-1-in., 1-in.-⅝-in., ⅝-in.-3/16-in. (No. 4), and sand. Instead of loading the cars with definite percentages of each of the coarse sizes, as had previously been done, each car was loaded with one size only, and only that size was put into a bin at the weighing hopper. The variation in size of particles was found to be so slight that no appreciable segregation took place in the weighing hopper bin. With three sizes available it was possible to supply any proportions desired, and to change proportions from batch to batch if necessary, to meet the requirements of the different jobs being serviced. It had the further advantage of eliminating all but three stock piles. Previously aggregate for special jobs had to be handled separately and the bins cleaned between jobs.

The most important advantage, however, was in the exact control over aggregate proportions which this made possible. Moisture determination and compensation held the cement/water ratio constant, and by varying the aggregate grading, ("inching up" on the coarse aggregate proportions), it was possible to secure and maintain a close approximation to the optimum grading and to hold it from batch to batch and from day to day. With this type of aggregate control it is entirely practicable to supply concrete of such close uniformity that it is impossible to detect any difference in appearance or handling between batches. Strength also shows surprising uniformity.

Shortly after completing the change-over to three coarse aggregates, as outlined above, the same

*Consulting Engineer. Preceding articles appeared in January, May, and June, 1945.

ready mixed concrete company supplied the concrete for a large industrial building. In pouring the floor slab, where uniformity was most important, transit mixed concrete, without any pre-mix, was delivered continuously day after day without any observable or measurable difference from batch to batch in workability, texture, or slump, and with minimum variation in strength of test cylinders.

In the practical operation of a gravel or stone grading plant there will be a certain amount of "over-run." It is impossible to make the cut-off exact at any point. For example, in the size through the 1½-in. and retained on the 1-in. screens, there will be a certain amount of material reaching the 1-in. screen which, with more complete screening than is economical or practical, would not go through the 1½-in screen. Such over-run is not serious unless the percentage is high, but the amount should be known and it should be kept constant within close limits. The way to check this is to make frequent sieve analyses. Unless this overrun is kept constant it will be impossible to control the mix accurately.

The number of aggregate sizes to be used will depend on local factors. On very large jobs, such as power developments, etc., it may be feasible to have as many as eight or ten. The very minimum for ordinary ready mixed plants should be three sizes of coarse aggregate and one sand. In many cases it will be found highly profitable to have ultra fine sand to use much the same as an admixture, and if there is sufficient mass or pavement work, it will also pay to have an extra large size, 2 in or 3 in. The size for concrete products plants will depend on the product. In general the aggregate should be no larger than 2/3 the minimum clear distance between reinforcement or forms, and for most work 3 in. is as large as is practicable. The following sizes are suggested for the ready mixed plant: Through 1½-in. and retained on 1-in. (1½-in.), 1-in. to ⅝-in. or ¾-in. (1-in.), ⅝-in. or ¾-in. to No. 4 (⅝-in. or ¾-in.), through No. 4 screen (sand). If possible two additional sizes should be available: through 2-in. or 3-in. to 1½-in. (2-in. or 3-in.) and through No. 50.

Aggregate Proportions for Maximum Density

The next step in the design of the mix is to determine the proportions, by weight, of each aggregate for the required mix.

A close approximation to the optimum mix can be secured by hand mixed trial batches. This is done by taking a known amount of one size and determining the amount of the smaller sizes which it will be necessary to add to give a mix whose density is approximately the maximum possible. The following detailed instructions will make this clear.

It is presumed that six sizes of aggregate are available—3-in., 1½-in., 1-in., ¾-in. or ⅝-in., regular sand, No. 50. The maximum density, and hence the most economical mix, will be secured when just enough of the smaller sizes are added to each successively larger size to give the maximum weight per unit volume. On account of the phenomenon of bulking, all aggregate, but especially the sands, should theoretically be saturated, surface dry. This however is impracticable. Sufficiently accurate results for all practical purposes will be secured if all aggregates are thoroughly air dried. Typical samples should be taken from the respective bins and spread out in the shade to dry for several days. Sieve analysis should be made of each sample. The equipment required is a platform scale, a one cubic foot measure, a shovel, a tamping rod and a mixing pan or platform where mixing can be done without loss of ingredients. If available, a vibrator should be used in making all measurements, otherwise standard rodding procedure should be followed.

The start in determining the optimum mix by this method is always made with the next to the smallest aggregate, in this case regular sand. Fill the cubic foot measure in standard manner with this sand and weigh, noting net weight of sand in measure.

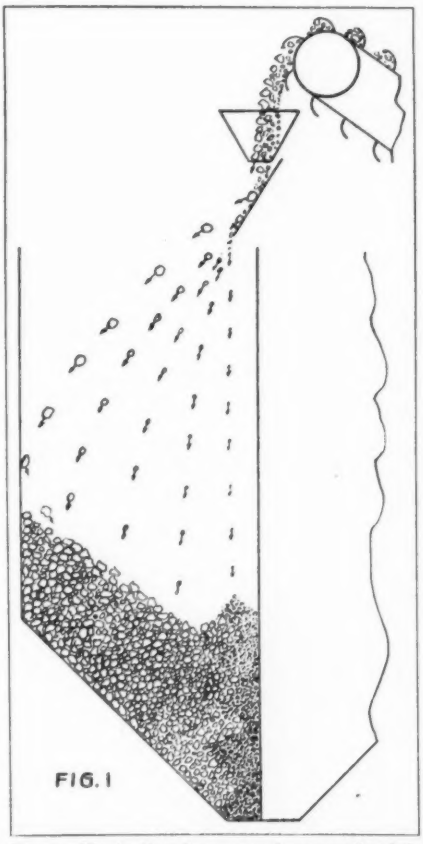

Fig. 1: Illustrating how gravel segregates into irregular layers

Pour out in mixing pan, and add a known weight of No. 50 sand, say 1 per cent. Mix thoroughly, fill measure, note weight of mixed sand. In most cases regular concrete sand has had too much of the fines washed out and is deficient in fines. If this is the case, the addition of fines will cause the unit weight to increase. If the sand already has sufficient fines, added fines will cause a decrease in unit weight. The sieve analysis of the sand will also give valuable information on the need for additional fines. If the above operation showed a slight increase in unit weight, repeat, adding additional increments of No. 50 until the unit weight starts to decrease. Care must be taken to avoid over loading with these extreme fines. Determine the proportions of regular and No. 50 sands which gave the maximum weight and add enough of the regular sand to bring the mix to these optimum proportions. The mixture so prepared will be close to maximum density for these two ingredients.

Next measure out 1 cu. ft. of the next size, ⅝-in. or ¾-in. Add to this a known weight of the mixed sand prepared above, say 10 per cent, mix, measure, weigh and record. Add another percentage and repeat. Continue until the unit weight has slightly passed the maximum and then bring the mix back to the optimum point by adding the larger size as outlined above. This, in turn, is a close approximation to the maximum density which can be secured with the three smaller sizes of aggregate.

The same procedure is followed with each successively larger size of aggregate. The 1-in. is "loaded" with the ⅝-in or ¾-in. mix till the maximum unit weight is determined; the 1½-in. with the 1-in. mix, and the 2-in. or 4-in. with the 1½-in. mix. Since all weights will have been recorded, the proportions by weight for the optimum mix for any maximum size can easily be determined.

The above procedure is valid and accurate when the aggregates have the same, or approximately the same, specific gravity, and when the fine aggregate has a lower specific gravity than the coarse. If, however, the coarse aggregate is very light, care and judgment will have to be used in determining the optimum mix, as added increments of the heavier aggregates will show a steadily increasing unit weight. The rate of this increase will, however, change at the point of maximum density. Accurate plotting of results will usually show the critical point.

The next step is to determine the amount of cement/water paste of the ratio necessary to meet job quality requirements which will be necessary with this optimum aggregate mixture. To do this a quantity of paste of the ratio to be used, or in the case of a

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Convention Program — Exhibits

National Concrete Masonry Association Convention and Exhibit at Hotel Sherman, Chicago, February 17 to 20, inclusive

ONE of the largest meetings in point of attendance and interest is expected for the 27th annual meeting of the National Concrete Masonry Association. Program topics are of unusual current interest.

Monday, February 17

On Monday, February 17, the morning session will be devoted to registration and group meetings of lightweight aggregate concrete products manufacturers. The aggregate and presiding leader are as follows: Celocrete, Austin Crabbs, Davenport, Iowa, room 114; cinders, Philip Paolella, Hamden, Conn., Bal Tabarin; Haydite, W. R. Stanley, Kansas City, Mo., room 111; pumice, A. G. Streblow, Napa, Calif., room 102; Superock, John S. Bailey, Atlanta, Ga., room 104; Waylite, Henry E. Buchholz, Chicago, Ill., Grey room. The natural aggregate division will hold a meeting at 3 p.m., in the Bal Tabarin with C. E. Swanson, Kansas City, Mo., presiding.

Exhibits

The exhibit will open at 1 p.m., and will be open to inspection thereafter every afternoon except Thursday, when the exhibit will open at 10 a.m. and close at 3 p.m.

Tuesday, February 18

The convention itself will open in the Grand Ballroom with President D. R. Lynde, presiding. Following the address of the president and reports of the treasurer, executive secretary, publications committee and nominating committee, the election of five directors will be held.

"The Apprentice Training Program —Its Relation to Increasing the Supply of Bricklayers," by Maurice M. Hanson of the Department of Labor, will be the first paper on the program. This will be followed by a panel discussion led by Philip Paolella, Hamden, Conn.; John L. Strandberg, Kansas City; and Sam Paturzo, Baltimore, Md.

"Labor Relations in the Plant" is the title of an address of Jos. A. Wilder, of Wilder, Van Slyke & Associates, Industrial and Labor Relations Consultants, Chicago, Ill., who will follow on the program.

Wednesday, February 19

On Wednesday, the program will open at 10 a.m. with a Technical session in the Grand Ballroom. R. E. Copeland, Director of Engineering of the association, will preside, and give his report on the technical program.

This will be followed by a report of the Technical Problems Committee, Jay C. Ehle, Chairman, Cleveland, Ohio, reports of sub-committee chairmen: Paul M. Woodworth, Chicago, Ill.; Hugo Filippi, Chicago, Ill.; Richard Carpenter, Buffalo, N. Y.; and Herbert Geist, Cleveland, Ohio.

"Reinforced Concrete Masonry — Its Merits and Applications" is the next paper on the program which will be presented by C. D. Wailes, Jr., Wailes-Bageman Co., Los Angeles, Calif.

"Prefabricated Floors of Concrete Masonry Units" will be presented by O. Neil Olson, head of the Department of Civil Engineering, Marquette University.

A Symposium on Plant Problems will include the following:

"Maintenance and Repair of Block Machines," by Horace Bush, Multiplex Concrete Co., with a discussion led by L. E. Schwalbe, Economy Block Co., Wauwatosa, Wis., and R. A. Utiger, Cinder Concrete Products, Inc., Denver, Colo.

"Hard Facing Welding in Maintaining Plant Equipment," by Ralph Reiner, Cleveland Builders Supply Co., Cleveland, Ohio.

"Operation and Maintenance of Steam Boilers," by A. A. Haltug, The Hurlbut Co., Green Bay, Wis.

"Production Cost Accounting and Control," by P. M. Clement, Katterjohn Concrete Products Co., Paducah, Ky.

Thursday, February 20

On the closing day of the convention, there will be a Merchandising Session in the Grand Ballroom at which Executive Secretary, E. W. Dienhart will preside. Subjects and speakers are as follows:

"Farm Business and How to Get It," by W. G. Kaiser, manager, Farm Bureau, Portland Cement Association. Mr. Kaiser will show a new motion picture with sound detailing opportunities in the farm market.

"A House Plan Service as an Aid in the Promotion of Concrete Masonry Houses," by C. A. Sirrine, Loree-Sirrine, architects, Ann Arbor, Mich.

"A Buyers' Market is in Prospect —Merchandising is Again in Order," by James M. Cleary, Roche, Williams & Cleary, advertising counsellors, Chicago, Ill. A typical complete radio program used by Chase Building Products, Fort Worth and Dallas, Texas, will feature Mr. Cleary's presentation.

"A Scotsman Looks at Modular Coordination," by A. Gordon Lorimer, Producers' Council, Washington, D. C., which will be illustrated with slides and charts which are used before meetings of architects.

At 2:30 p.m. the inspection trip to the new ultra modern plant of The Illinois Brick Co., will start from the Hotel Sherman in buses. The tickets for the round trip will cost $2.50. Refreshments will be served at the plant.

EXHIBITS

ONE of the largest and most comprehensive displays of machinery and materials of interest to concrete products manufacturers will be on exhibit at the Hotel Sherman, Chicago, February 17 to 20. Details of these exhibits supplied by holders of space are as follows:

J. W. Appley & Sons, Inc., St. Petersburg, Fla., will show a partial Appley assembly, including machine, mixer and hopper. This is a new mixer, skip hoist, hopper, block machine assembly.

Barrett-Cravens Co., Chicago, Ill., will exhibit its PowerOx and the concrete products truck.

Berg Vault Co., St. Louis, Mo., will display one of its Bronzoleum concrete vaults.

Frank I. Blatt Sales Co., Inc., Rattlesnake, Fla., plans to have one of its controlled oscillation block machines operating under slow motion.

Besser Manufacturing Co., Alpena, Mich., will have on display at its booth a model of advanced design "push-button" concrete products plant. Designed and built to exact scale, the plant model is complete in every detail, including storage yard, and is fully motorized to demonstrate various phases of plant operation. It will show the operations of mixing concrete, making block, handling block, block cubing and power loading. The model will be 9- x 15-ft.

The Celotex Corporation, Chicago, Ill., will have on display photographs of jobs constructed with Celocrete lightweight concrete, both interiors and exteriors.

Cities Fuel & Supply Co., West Allis, Wis., will show samples of Dox block floor and roof planks with a background of photographs and test data.

The Commercial Shearing & Stamping Co., Youngstown, Ohio, will have a representative line of pressed steel pallets in both the regular and modular type; also one or two of the jigs used to check the accuracy of pallets as they come from the machine.

Construction Machinery Company, Waterloo, Iowa, is featuring its C.M.C. bin batcher and C.M.C. Roll-O-Hoist, a new electric elevating unit. It will also show concrete mixers, hoe type mixers, tamps, hoists, power saws, electric generating plants and concrete carts.

Roy Darden Industries, Inc., Atlanta, Ga., will probably have a Handy-Van lift truck on exhibit and blown-up photographs of major items of its block machine equipment.

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Influence of GRADING On Strength of Concrete

By BENJAMIN WILK*

How can concrete products manufacturers improve quality and decrease costs?

That is always a question in the minds of progressive products manufacturers and one of the important answers can be found in a study of the effect of grading of aggregates.

The importance of aggregate grading on the strength of concrete was recognized by the early researchers in concrete. They pointed out that coarse sand was much to be preferred to fine sand. The phrase "Coarse particles predominating" in describing aggregates was frequently used in specifications. While this information was of some value in the production of mass or reinforced concrete, it was of particular interest to products manufacturers who use aggregates less than ½ inch in size.

In this field the grading of aggregates is of particular importance because there is a distinct loss of strength in the use of too much fine aggregates. The committee on Products Plant operation of the American Concrete Institute about 20 years ago made reports on tests on concrete products. It pointed out that aggregates having the greatest percentage of coarse particles will make the strongest concrete provided it can be satisfactorily handled by the block machine. The fine aggregate frequently used produces a smooth appearing product at the sacrifice of strength. Such aggregates should be corrected by the addition of coarse particles.

To make it simple to compare one aggregate with another it is necessary to make a sieve analysis of the aggregate. The sieve sizes generally used express the number of openings per linear inch, such as 100, 48, 28, 14, 8, 4. Sieve analyses are expressed as percentages coarser than each sieve. "Fineness Modulus" is the sum of the percentages in the sieve analysis divided by 100.

Fine drift or beach sand has a fineness modulus of approximately 1.50. It is graded to No. 28 sieve. Medium sand graded up to No. 8 sieve has a fineness modulus of approximately 2.50. Coarse sand graded to the No. 4 sieve has a fineness modulus of from 3.0 to 3.25. Roofing gravel graded from No. 4 to ⅜ has a fineness modulus of approximately 5.50.

To show the difference in strength depending on the fineness modulus, concrete building tile were made using two mixes, 1:3 and 1:5 with 3 gradings.

		Fineness Modulus Combined	Strength per Square Inch
1:3 Mix	100% Medium Sand	2.8	1300
1:5 Mix		2.8	770
1:3 Mix	66⅔% Medium Sand	3.75	1500
1:5 Mix	33⅓% Pebbles	3.75	1160
1:3 Mix	50% Medium Sand	4.25	1580
1:5 Mix	50% Pebbles	4.25	1290

In other words a 1:5 mix with 4.25 fineness modulus was equal in strength to a 1:3 mix with 2.8 fineness modulus. A number of mixes were tried out for making concrete building tile and the following mixes proved best.

Sieve Size	Per Cent Retained
100	94
48	88
28	71
14	55
8	37
4	24
Fineness Modulus	3.69

The fineness modulus alone does not tell the entire story and coarseness alone is not sufficient. A certain amount of fine aggregate must be used to get best results. This is shown by a series of tests reported by Committee 710 to the American Concrete Institute (Feb. 25-27, 1936) using 94 lb. normal cement as compared with 70 lb. high-early-strength cement.

GRADING OF AGGREGATES

Sieve	Per Cent Retained		Sieve Sizes Indicated
	⅜-50	⅜-100	⅜-200
4	24	23	23
8	46	43	42
14	66	60	58
28	84	76	72
48	100	89	83
100	100	100	92
Fineness Modulus	4.20	3.91	3.70

EFFECT OF GRADING ON COMPRESSIVE STRENGTH

Age Days	⅜-50 Cement		⅜-100 Cement		⅜-200 Cement	
	(Strength per Sq. In.)					
	Normal	HE	Normal	HE	Normal	HE
4	2020	2565	2140	2420	2210	2860
7	2560	3375	2650	3250	3050	3570
28	2785	3780	3030	3590	3310	4110

An additional set of tests were made using a single fineness modulus but with variations on the different sieves.

GRADING OF AGGREGATES

Sieve	Per Cent Retained		Sieve Size Indicated
	⅜-50	⅜-100	⅜-200
No. 4	20	37	35
8	40	48½	70
14	60	60	70
28	80	71½	70
48	100	83	70
100	100	100	85
Fineness Modulus	4.00	4.00	4.00

EFFECT OF GRADING ON COMPRESSIVE STRENGTH

Age Days	⅜-50 Agg. Cement		⅜-100 Agg. Cement		⅜-200 Agg. Cement	
	(Strength per Sq. In.)					
	Normal	HE	Normal	HE	Normal	HE
4	1490	1700	2150	2640	2150	2680
7	2190	2350	3020	3350	2860	3190
28	2540	2560	3740	4110	3600	3780

These two series of tests would indicate that it is desirable to have aggregates in each sieve size. Taking into account the necessity for producing a product that does not have a rough appearance, it is suggested that an easy sieve analysis to remember which will give good results is:

Sieve Size	Per Cent Retained
4	25
8	40
14	55
28	70
48	85
100	95
Fineness Modulus	3.70

This means 25 per cent retained on the No. 4, 5 per cent through the No. 100, and 15 per cent on each of 8, 14, 28 and 48. If the source of material cannot give such a well balanced aggregate, it may be worth while to get separate roofing gravel, coarse sand, and fine sand from more than one source.

In order to see the effect of using this recommended 3.70 grading, a series of 3- x 6-in. cylinders were recently tested in association with the testing department of the building department of the City of Detroit with various gradings. The consistency was similar to that used in making concrete block. The cylinders were vibrated, and kept under water for 21 days after which they were dried out to constant weight before testing. Each aggregate was weighed out accurately. Three cylinders were made from each batch.

SIEVE ANALYSIS OF AGGREGATES

Sieve	Roofing Gravel % Retained	Coarse Sand % Retained	Fine Sand % Retained
4	71.0	1.0	.3
8	95.0	12.0	.6
14	98.2	33.8	1.5
28	99.5	61.0	10.0
48	99.8	91.0	43.5
100	100.0	97.0	93.0
Fineness Modulus	5.64	2.96	1.49

*Vice-president, Standard Building Products Co., Detroit, Mich.

These aggregates were proportioned in various combinations using equal amounts of roofing gravel and coarse sand, but varying the fine sand from nothing to 45 per cent of the total amount of aggregate.

SERIES I:

Test No.	Roofing Gravel Grams	Coarse Sand Grams	Fine Sand Grams	F. M. of Mixed Aggregate	Per Cent Water	Compression Strength per Sq. In.	Average
1	500	500	0	4.30	7%	3309 3638 3169	3372
2	475	475	50	4.16	7%	2861 2964 3235	3020
3	450	450	100	4.02	7%	2419 2502 2450	2457
4	425	425	150	3.88	7%	2811 3090	2811
5	400	400	200	3.74	7½%	3124 3088 2346	3101
6	375	375	250	3.59	7½%	2542 2281 2192	2390
7	350	350	300	3.44	7½%	2133 2053 1821	2110
8	325	325	350	3.30	7½%	1820 1782 1693	1807
9	300	300	400	3.16	8%	1430 1527 1527	1550
10	275	275	450	3.02	8%	1326 1532	1462

SIEVE ANALYSIS OF MATERIALS

Sieve Size	Roofing Gravel	Per Cent Retained Coarse Sand	Fine Sand	Actual Combined Grading	Proposed Theoretical Grading
4	70.0	1.0	.3	28.5	25.0
8	95.0	12.0	.6	42.9	40.0
14	98.2	33.8	1.5	53.0	55.0
28	99.5	61.0	10.0	66.2	70.0
48	99.8	91.0	43.5	85.0	85.0
100	100.0	97.0	93.0	97.4	95.0
	5.63	2.96	1.49	3.730	3.70

Concrete used in tests No. 1-No. 3 would be too coarse for manufacturing block but series No. 5 with fineness modulus of 3.74 would give a good block appearance. The concrete in series No. 8-9-10 looked very much like the concrete produced by some products manufacturers. But the strengths in Nos. 8-9-10 are less than half of the strengths in No. 5.

It is interesting to compare the suggested grading of 3.70 with the actual grading of the combined aggregates in test No. 5. Calculating from the proportions of 40 per cent roofing gravel, 40 per cent coarse sand, and 20 per cent fine sand gives a fineness modulus of 3.73.

These figures would indicate that by using three gradings of material; such as, roofing gravel, coarse sand, and fine sand a combination can be obtained that will give maximum strength.

It is therefore suggested that each products manufacturer make sieve analysis of his aggregates. Then use enough separate sizes, so that when recombined the resultant will be close to the suggested grading. With this grading and with a few gradings coarser and also finer to determine the grading that will give the best results in that particular plant.

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....Clutches
....Coal Pulverizing Equipment
....Concentrating Tables
....Concrete Mixers
....Concrete Mixing Plants
....Concrete Specialty Molds
....Concrete Waterproofing and Dampproofing
....Conveyors
....Coolers
....Cranes
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....Diesel Engines
....Dragline Cableway Excavators
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....Grinding Media,
....Gypsum Plant Machinery
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....Scales
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....Trucks, Mixer Body
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....Welding & Cutting Equipment
....Winches
....Wire Rope

If equipment you are in market for is not listed above, write it in the space below.

_____

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Research Service Department
ROCK PRODUCTS
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Complete Concrete Block Plant Equipment

BY THOSE WHOSE ENTIRE CAREERS WERE DEVOTED TO ACTUAL CONCRETE BLOCK PLANT OPERATION

Built for us by Link-Belt Co., Atlanta plant

For the Medium Producer, The Reasonable Priced "Rockercrete." 1800 to 2250 8″x8″x 16″ or Equivalent Units Per Eight Hour Day. Air valves and push button give perfect operator control. No heavy physical exertion required. Leveling head and heavy vibration assure a very compact, even density block.

★

Engineering service—by men who know how our machinery should be installed—assures efficient trouble-free operation. Also available: mixers in 12, 28 and 50 cubic foot sizes, material bins, motorized lift trucks, hand lift trucks, pallets, drag flight conveyors, chain bucket conveyors and racks.

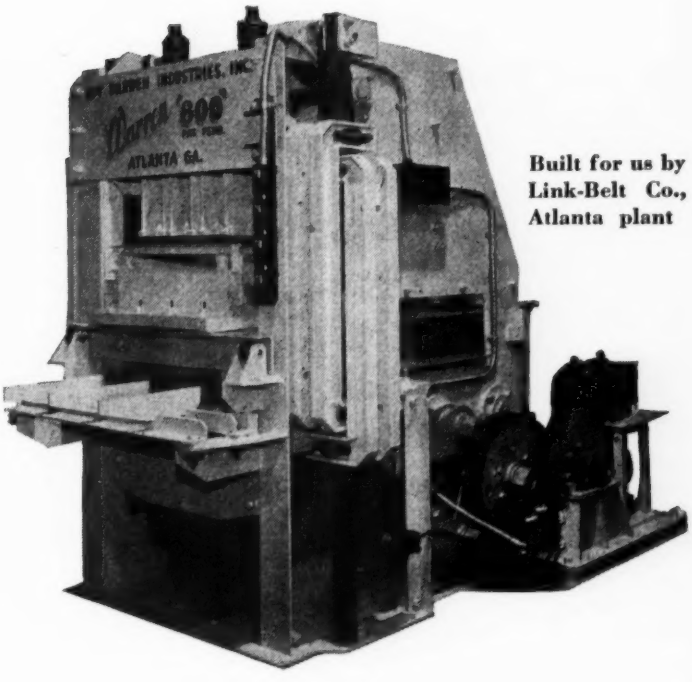
See us at booth forty-four at the Concrete Industries Exposition in February!!!

★ ★ ★

For The Large Operator

The high production Warren "800". Minimum production—800 8″x8″x16″ or equivalent units, or almost 10,000 bricks per hour. Uses a 9 lb., plain marine plywood pallet that requires oiling only every two weeks.

Fully automatic—requires one man only at front of machine for offbearing.



Built for us by Link-Belt Co., Atlanta plant

ROY DARDEN INDUSTRIES, INC.

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313 Bona Allen Building
Atlanta 3, Georgia

Southwestern Division
1125 Stonewall Street
Dallas 10, Texas

Cable Address: "Darden"

NEW MACHINERY

Air-Operated Block Machine

WESTERN SALES & MANUFACTURING Co., Seattle, Wash., recently announced that B. & W. Brick & Mate-

Two block automatically emerging by compression from the mold box of pneumatically operated machine

rials Co., Chicago, Ill., had taken over national sales distribution of its pneumatically-operated block machine. This machine embodies a combination of vertical vibration simultaneously with compression, and is said to have given several years of satisfactory service in the western part of the country.

In this unit, three pistons are used, each one inside the other, the complete assembly being centered and mounted directly under the mould box. The smaller inside piston does the vibrating and is bolted to the stripper bar and rests directly on the vibrating tool (2200 impulses per minute). The next larger middle piston contains the entire vibrating assembly, and is used as the lift piston. The larger outer sleeve is used only as a guide for the above mentioned lift piston.

By using this method, it is claimed that a true vertical vibration is obtained direct from the base to the aggregate in the mould box. In other words, the machine stands perfectly still and vibrates the concrete in the mould box only. The result of such vibration is said to mean faster operation and elimination of machine breakdown.

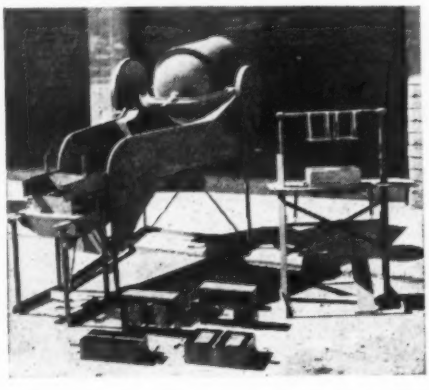
On top of the machine is a table piston which operates the cut-off plate which also acts as a head pressure plate. An allowance has been made in the depth of the mould box for compression of the aggregate by means of application of the air on the lift piston while the cut-off plate is still over the top of the block. The single air machine will turn out an average of around 1600 block in eight hours, and the double air machine about 3000 block in eight hours, according to the manufacturer. Machines are operated with a 5 hp., 25 c.f.m. air compressor.

The company also makes an electric vibrator type block machine with working parts mounted in rubber. A mixer also is manufactured by this company for use with its automatic block machines.

Small Block Machine

MORRIS MANUFACTURING Co., Bakersfield, Calif., is manufacturing a portable tile, brick casting machine which was originally designed by Frank Morris for the purpose of producing concrete units for the construction of resident courts for himself. Three factories in the United States and one in Canada are now making the machine. Recently the company has added four different types of concrete mixers to its line.

The portable tile, brick casting machine will make 30 different sizes



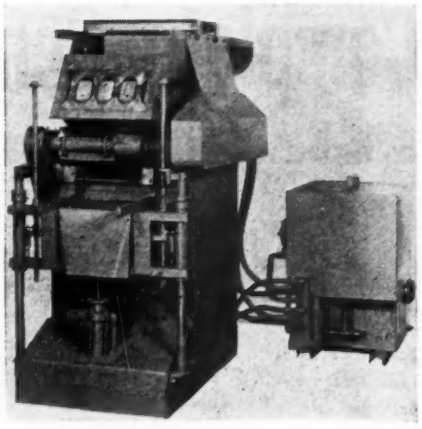
Small mixer and concrete block machine equipment

and types of brick. Electrical outlet openings also are cast in the block to be laid as the structure is built. Special molds can be furnished upon request. The machine is powered by 2⅓ hp., 110-volt motors, and is of the vibrator type.

Hydraulically Operated Block Machine

FLEMING MANUFACTURING Co., INC., St. Louis, Mo., has brought out an improved Kirkham Vibrator which will be known as the FMC 180. The Vibrator will continue to be manufactured as the FMC 100.

Basically, the FMC 180 is the same machine as the Kirkham Vibrator. The operator places a pallet on the mold box and off-bears the block, the machine automatically continues the other operations. Machine is equipped with two 1½ hp., 3-phase motors, wired on independent circuits. The hydraulically operated power unit is built in one compact unit on a separate frame. The pump operates on low pressure for safety and is



One-man operated block machine

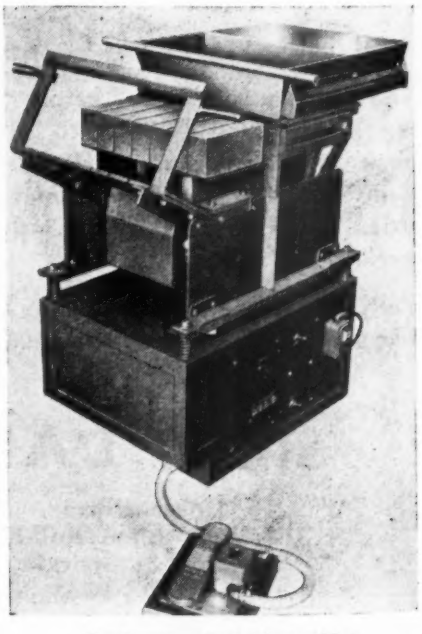
equipped with a unique type, 6-way valve. Hydraulic fluid may be replenished when necessary at a point easily accessible.

Machine operation has a controlled fixed speed which may be varied by resetting, for production of 120 to 180 standard 8- x 8- x 16-in. units per hour. Only one man operates machine.

Concrete Brick Machine

THE R. S. REED CORPORATION, Three Rivers, Mich., has brought out a brick machine known as the Vi-Brik-Crete. The model 750, with model 520 hopper, has been designed as a semi-automatic machine to produce 28 concrete brick per minute. The multiple molding capacity is 7 brick, using low cost plain pallets of wood or steel.

A heavy duty vibrator, operating at 3600 impulses per minute, is foot switch controlled for immediate full power action without over-travel, insuring a short molding cycle of 15 seconds. A built-in electronic control allows the operator to vary the amplitude of vibration at will permitting a wide range of mixes and aggregate selections. It is said to be well suited to lightweight aggregates.



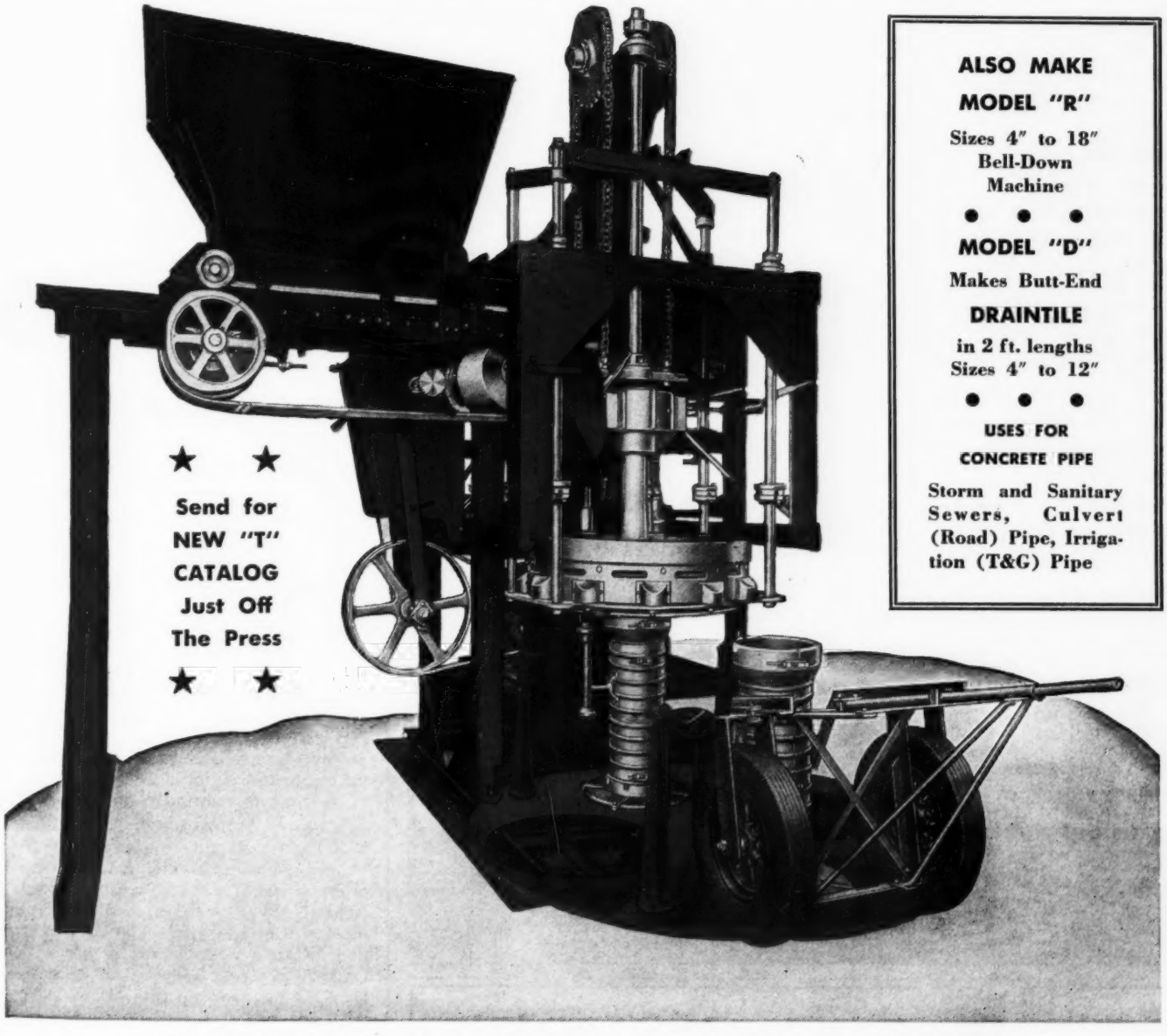
Semi-automatic brick machine

Concrete Pipe Machinery Co.

MODEL "T" BELL-UP "McCRACKEN" MACHINE

FOR MAKING PLAIN AND REINFORCED CONCRETE PIPE

Range of sizes—4" to 36"—90% of the Market



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Send for NEW "T" CATALOG Just Off The Press

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ALSO MAKE

MODEL "R"

Sizes 4" to 18" Bell-Down Machine

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MODEL "D"

Makes Butt-End

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in 2 ft. lengths
Sizes 4" to 12"

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USES FOR CONCRETE PIPE

Storm and Sanitary Sewers, Culvert (Road) Pipe, Irrigation (T&G) Pipe

PACKER-ROLLER-HEAD PROCESS

LEADS THE WAY TO MORE PROFITABLE PIPE BUSINESS

Eight-Hour Shifts Produce:

SEWER

Plain B & S Pipe —

2400 feet — sizes 4" to 10"
1750 feet — sizes 12" to 18"
1200 feet — sizes 21" to 24"

For Full Details Write to

CULVERT "ROAD"

Reinforced T & G Pipe —

1600 feet — sizes 12" to 18"
1100 feet — sizes 21" to 24"
900 feet — sizes 30" to 36"

Concrete Pipe Machinery Co.

EXPORT OFFICE
50 Broad St., New York (4) N. Y.

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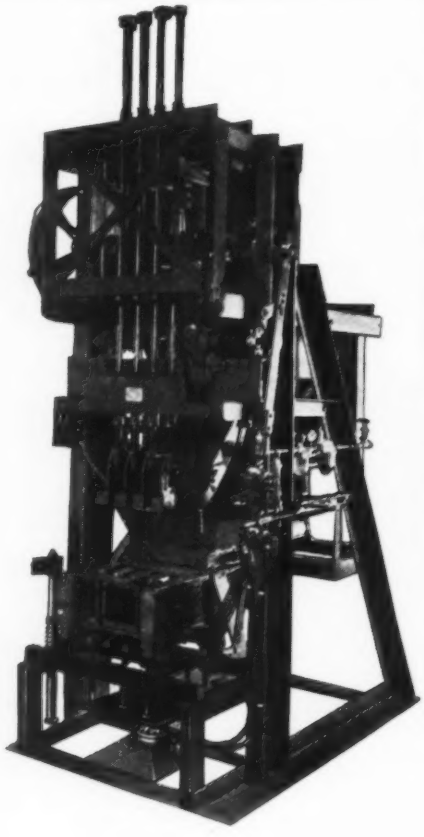
300 HIGH QUALITY CONCRETE BLOCKS PER HOUR WITH THE—

KELLEY

AIR OPERATED POWER STRIPPER



You can make 300 perfectly formed 8x8x16 in. cored block per hour with the Kelley Air Operated Power Stripper.

Machine is strongly built and simply designed to insure minimum initial and operation cost. All ordinary wearing parts available from stock and easily installed.

Attachments for making 3, 4, 6, 8, 10 and 12 in. widths and fractional lengths, sash, corner, etc.

KELLEY will assist in designing your new plant for maximum efficiency.

Other KELLEY Equipment

Paddle Blade type mixers of the most simple and efficient design with clutch pulley or direct motor drive.

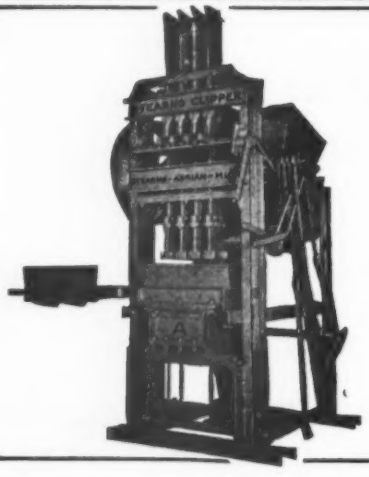
Skip Hoists, Conveyors, Hoppers, Bucket Elevators, Screens, Crushers, Lift Trucks, Racks and Pallets.

30 Years of Service to Industry

Everything for the Concrete Products Plant

E. B. KELLEY CO.

Farmingdale — New Jersey



"ANCHOR"

Complete equipment for making concrete, cinder and other light weight aggregate units, including engineering service for plants and revamping of old ones for more economical service. Stearns Clipper Stripper Machines, Stearns Joltcrete Machines; Stearns Mixers; cast Iron and Press Steel Pallets. Straublox Oscillating Attachments, etc.

Repair parts for: Anchor, Stearns, Blystone Mixers and many others.

ANCHOR CONCRETE MCHY. CO.

G. M. Friel, Mgr., Columbus 8, Ohio

Exhibits

(Continued from page 160)

W. E. DUNN MFG. CO., Holland, Mich., will be represented by "Cappy" Buys. Concrete Equipment Co. will be represented by Norman A. Dunn, and Colorcrete Industries, Inc., by Russell C. Reeve. No equipment will be on display, but literature will be available on Dunbrik equipment and Korpak block machines.

EQUIPMENT ENGINEERING CO., division of Nall Corporation, St. Charles, Ill., will have information, photographs, and literature available describing its complete one-level concrete block manufacturing plant.

ERICKSON SPECIAL EQUIPMENT MANUFACTURING CO., Minneapolis, Minn., will show a large number of action photographs of its power lift trucks in operation. In addition to its regular line of trucks, information will be available concerning its Super Special power lift truck adapted for use in concrete pipe handling.

FLEMING MANUFACTURING CO., St. Louis, Mo., will display its new automatic block machine, Model FMC-180. Other equipment also will be on display.

FORD CEMENT BLOCK MACHINE CO., Cedar Falls, Iowa, will have on exhibit one of its block machines. Pallets and a few block made on the machine also will be shown.

F. C. GEORGE MACHINE CO., Orlando, Fla., will show a single unit "Little George," hand-operated machine; a two-unit George Super "V," hand-operated, and the same machine, hydraulically operated.

BOB GRAVELY INDUSTRIES, INC., Orlando, Fla., will display two models of its "Better Built" vibrators for making block and brick; also a 12-cu. ft. batch mixer. The two-unit vibrator, called the Imperial, is hydraulic power operated, and the Regal single unit vibrator is similar to the other model but is manually operated.

HAYDITE PRODUCERS ASSOCIATION will have a display of Haydite lightweight aggregate and various concrete products manufactured with this lightweight aggregate, including block, precast roof slabs, precast floor slabs, joists, lintels, etc. The Carter - Waters Corporation, Kansas City, is sponsoring this booth along with the users of its aggregates.

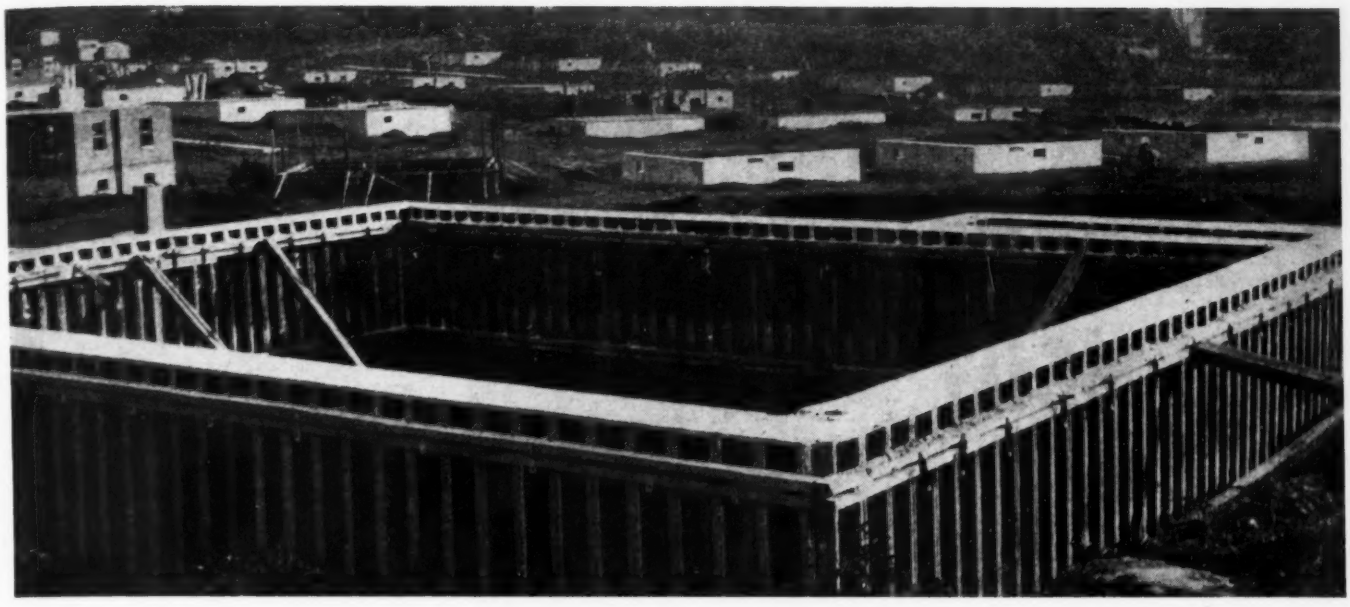
HOLLOSTONE CORPORATION, INC., Los Angeles, Calif., will show large blown-up photographs of a Hollostone home with ribbons attached to actual samples of block.

JACKSON & CHURCH CO., Saginaw, Mich., will exhibit a full-scale brick machine, Model NC. It will also show a concrete mixer, and movies will be displayed of operations at several brick plants. Photographs of buildings made with concrete brick will be used.

THE C. S. JOHNSON CO., Champaign, Ill., will have available photographs of complete plant installations

(Continued on page 176)

ATLAS LABOR-SAVING *SPEED* FORMS



BOOST YOUR PROFITS
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Atlas SPEED Forms

SAVE On Contracts You Handle Complete . . .
Stock Forms For Rental To Ready-Mix Customers

STEEL Forms—good for re-use indefinitely without repair. Easy to erect, strip and move. Go together with wedge bolts. Simple to assemble with a hammer. Even unskilled labor can set them. Adjustable for all conditions. Inserts easily accommodated. Interchangeable for walls or flat slabs. No grain marks, knots or honeycombs.

Patent applied for.

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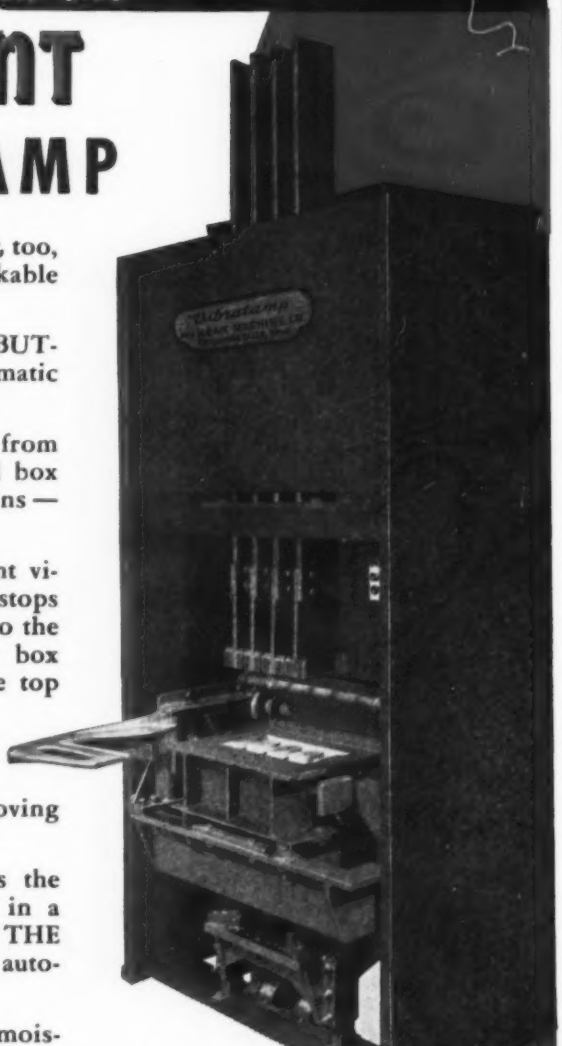
There's an Atlas Labor-Saving Form for every purpose. Wall, flat slab, column, tunnel, bridge, caisson, bin, road, sewer, manhole, pipe, etc.

Atlas *Labor-Saving* Concrete Forms for every Purpose

Now—
to Amazingly Advance
BLOCK MAKING
comes
"PUSH BUTTON"
CYCLE CONTROL
in the
KENT
VIBRA-TAMP



...es, you'll say *amazing,* too, ...en you see this remarkable ...achine in operation.

Simply "PUSH A BUT-TON" to start an automatic cycle.

Aggregate is carried from the hopper to the mold box evenly — vibration begins — tamping starts.

At the correct moment vibration ceases—tamping stops —the tamp bars return to the idle position—the feed box recedes, striking off the top of the block.

The block is stripped —the off-bearer swings under the pallet—all moving parts stop.

The attendant swings the ...off-bearer away—drops in a ...allet — and PUSHES THE ...UTTON to start a new auto-...atic cycle.

...ense blocks, of any moisture ... content, are produced at rates ...up to 300 per hour. Production mounts—costs drop —all ...ith a new minimum of ...uentic... and physical effort.

Think
What You Can Do

with this unusual machine—then ... for illustrated circular with complete ...mation at once.

The KENT MACHINE COMPANY
Manufacturers of CONCRETE PRODUCTS MACHINERY Since 1925
CUYAHOGA FALLS, OHIO, U.S.A.

...ELEVATORS • CONTINUOUS MIXERS • BATCH MIXERS • AGGRE-...STEEL RACKS • PALLETS • DUNKERS • COMPLETE BLOCK PLANTS

Exhibits

(Continued from page 174)

as well as component parts of Johnson bin equipment. Electrically illuminated blueprints will feature this exhibit.

THE LITH-I-BAR CO., Holland, Mich., is planning to have its new block machine on display and illustrations of its joist machine in action.

MASTER VIBRATOR CO., Dayton, Ohio, is planning to show all of its concrete working tools, including gas-electric concrete vibrators, Master Turn-A-Trowels, and vibratory concrete finishing screens.

MALL TOOL CO., Chicago, Ill., will show concrete vibrators with surfacing attachments, portable saws for cutting and scoring concrete, and various models of portable electric drills and electric saws.

MAXON CONSTRUCTION CO., INC., Dayton, Ohio, will display photographs of its Dumpcrete body delivering concrete on paving work, and also pictures of this body hauling sand, gravel, earth and coal. A model of the Dumpcrete body mounted on a truck chassis will be on display.

THE MULTIPLEX CONCRETE MACHINERY CO., Elmore, Ohio, expects to have on display a Super Tamper block machine, a Multi-Mixer, and possibly a hand machine. Aluminum pallets also will be shown. The Super Tamper is a combination vibrating and tamping machine.

PRIMA PRODUCTS, INC., New York, N. Y., is planning to have a visual demonstration of the working qualities of Aquella, a water-proofing material.

R. S. REED CORPORATION, Three Rivers, Mich., will display its new Model 750 Vi-Brik-Crete with hopper, the Model 400 Little Dave Brickmaker, and a new machine, Model 401 brickmaker. Syntron electric hammers and mold vibrators also will be shown.

ALBERT F. SCHAFER, Rochester, N. Y., will display its latest copy of the Estimating Book for Lumber and Building Supply Dealers. Mr. Schaefer is still associated with Schaefer Bros. Building Supply Co., and the Concrete & Cinder Block Products Co.

STEARNS MANUFACTURING CO., INC., Adrian, Mich., will show many of its concrete block machines, and some of them will be operated under power.

THE STONE MACHINERY CO., INC., Syracuse, N. Y., will demonstrate its Stone-Saw No. SS 20, using both the new Di-Bond diamond cutting wheel and abrasive wheels.

TAMMS SILICA CO., Chicago, Ill., will display concrete block coated with Tamms Agraseal which is a water-proofing coloring material. It can be used on a lightweight aggregate block or cinder block.

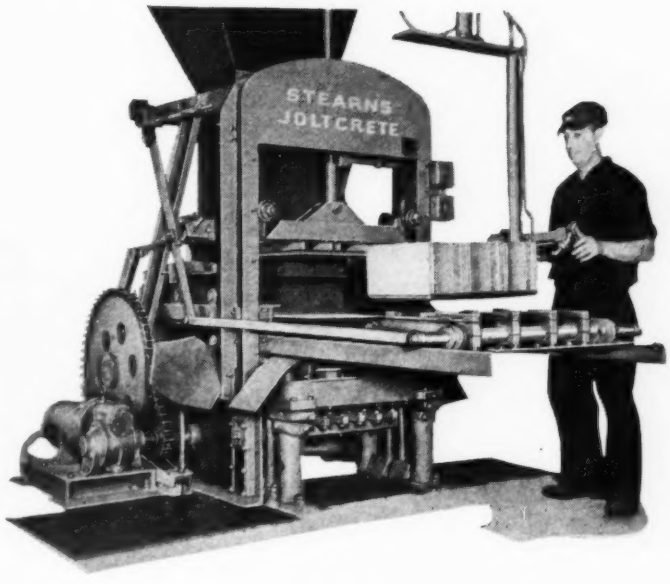
THE YODER CO., Cleveland, Ohio, will show a testing machine which will determine compressive strength of any block from 8- x 12- x 16-in. down.

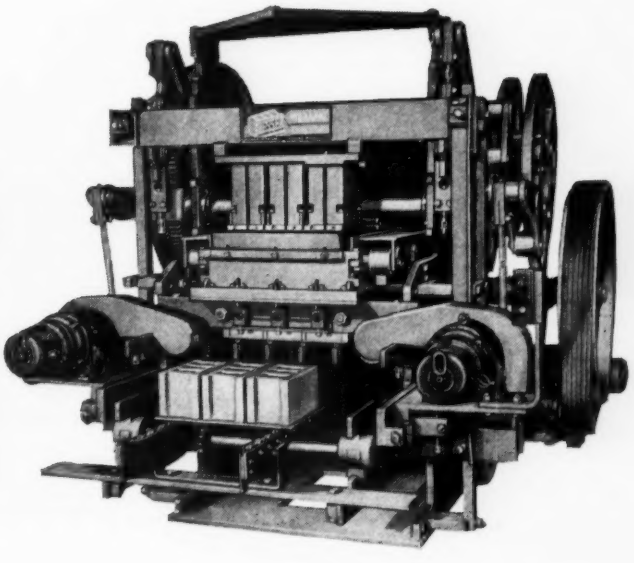
Vibration Under Pressure

→ **LOUIS GELBMAN,** inventor 750 Edgewater Road, New York City

ONLY announces . . .

STEARNS MANUFACTURING COMPANY AND BESSER MANUFACTURING COMPANY ARE THE MANUFACTURERS LICENSED TO MAKE BLOCK MACHINERY UNDER HIS PATENTS . . . . . .





1,867,144
2,003,632
2,069,880
2,366,780
2,029,365
2,251,447
2,269,955
2,275,676
2,360,122

OTHER PATENTS PENDING

Claim No. 1

A method for making a building block consisting in moving a feed drawer with plastic material across a vibrating mold by starting on one side of the mold and moving the said drawer until it is superimposed on the mold to fill and pack the mold, quickly moving said feed drawer off the mold to strip excess plastic material from the mold, and quickly applying a pressure head upon the top of the material in the mold during continued vibration of said mold.

WARNING

ALL PERSONS MANUFACTURING, SELLING AND USING CONCRETE BLOCK MACHINERY ARE ADVISED TO CHECK THE ABOVE PATENTS AS ALL INFRINGERS WILL BE PROSECUTED TO THE FULL EXTENT OF THE LAW.

ADD TO YOUR PROFITS
with a
WOOTEN
drain tile
machine

• You can get into the profitable, uncrowded drain tile business at a minimum investment with Wooten Drain Tile Equipment.

Produces up to 2,000 tile per 8-hour shift . . . 2 tile per casting . . . simple accessible design . . . ruggedly built for long-time, high capacity service.

Write for information about the Wooten complete line of concrete products equipment.

2 TO 5 WEEK DELIVERY

C. M. WOOTEN CO.
2717 Central Ave.
Knoxville, Tennessee

Curing

(Continued from page 157)

shape, size, boiler capacity, blocks per rack and per kiln, production rate, type of cement, type of aggregate, and a number of other details incidental to live steam curing with low pressure steam. The steam entering the kilns at the William Moors plant raises the air temperature 60 deg. per hour which is within 10 per cent of the temperature rise calculated from the boiler capacity, size of boiler header, size and length of mains and size of steam nozzle. It was noted that the velocity of the steam entering the kiln was a deciding factor on the uniformity of results obtained. If the velocity was too great, the steam impinges directly on the back wall of the kiln and would cause the condensing out of the water vapor. This releases part of the total heat available into sensible heat, thus raising the dry bulb temperature of the air in the kiln and reducing the relative humidity and vapor pressure of the air in the kiln. If too low a steam velocity was used, the temperature gradient of the air in the kiln varied considerably from top to bottom and from front to rear. The distribution and velocity of the steam is dependent upon the physical characteristics of the kilns as the velocities for various shapes of kilns range from 10,000 to 40,000 ft. per minute.

This system of curing has been installed in a number of plants in the Detroit area by the Concrete Curing Corporation, and in all cases the operators are well satisfied. Others are being installed in other sections of the country, and each is designed for specific kiln shapes and plant production rates. A sample of the variations of kiln capacities and shapes can be seen from the following:

Size	Capacity—Block
4 ft. 6 in. x 7 ft. x 65 ft.	864
9 ft. x 7 ft. x 65 ft.	1,728
13 ft. x 7 ft. 6 in. x 35 ft.	1,440
8 ft. x 7 ft. 3 in. x 62 ft. 6 in.	1,728
13 ft. x 7 ft. 6 in. x 28 ft.	1,080
8 ft. x 7 ft. 3 in. x 84 ft.	2,160

Summarizing the tests and curing system discussed herein, it can be concluded that specification strength and absorption in masonry units can be obtained in 24 to 48 hours, the units are highly resistant to shock and undoubtedly are of high durability, although tests will be conducted for verification. The moisture content can be easily reduced to within specification limits and plans are in order for a study of moisture removal with and without the aid of dessicants. The curing system is not complex, requires no complicated or expensive controls which in turn makes for ease of operation and eliminates costly breakdowns. The operating cost under this system varies from one to 1½ mills per 8-in. equivalent unit.

REFERENCES

(1) Psychrometric Chart for High Temperatures—Carrier Corporation
(2) Thermodynamic Properties of Moist Air—A.S.H & V.E. Guide, 1946
(3) The Chemistry of Cement and Concrete—F. M. Lea and C. H. Desch

EDGAR'S *COMPLETE* BLOCK MAKING ASSEMBLY...

Assures Speedy, Economical Production !

Now, from Edgar's Block Machine Works, you can obtain a *complete block making assembly.* This eliminates all necessity, after the purchase of an Edgar Vibra-Shaker Block machine, of "shopping around" for equipment essential to supplement the machine itself.

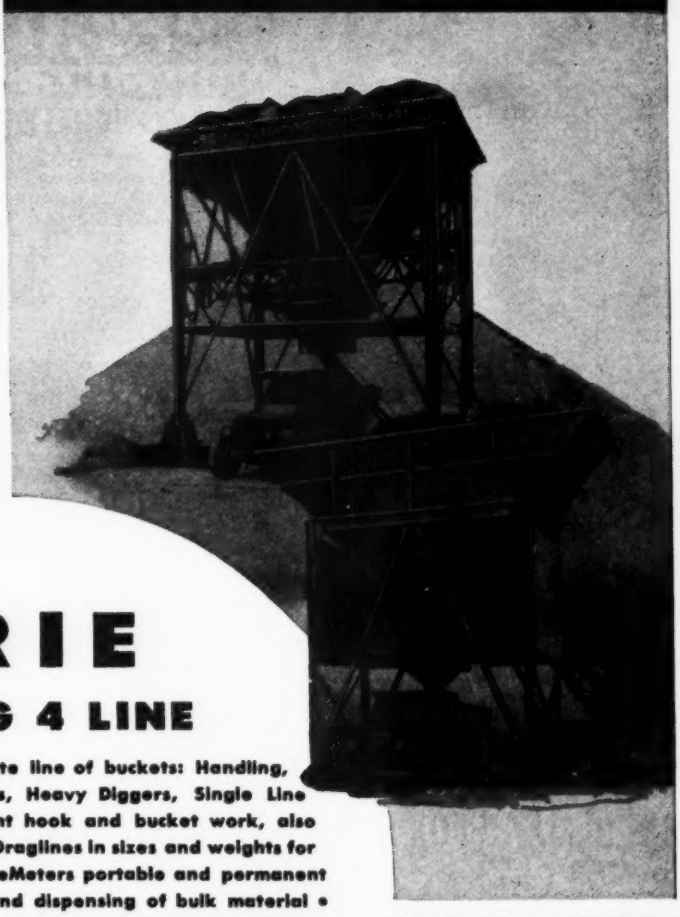
More than that—Edgar's MIXER, Edgar's HOPPER and Edgar's MUD CONVEYOR, are especially designed to create a smooth-functioning block making unit that will withstand the most rugged usage and give maximum, economical production.

Of *UTMOST IMPORTANCE* is the fact you can have *immediate delivery.* Write or wire for full details.

ORMOND EDGAR'S BLOCK MACHINE WORKS FLORIDA

BUCKETS

AGGREMETERS



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THE BIG 4 LINE

ERIE builds the most complete line of buckets: Handling, Rehandling, Light Diggers, Heavy Diggers, Single Line Hook-On type for intermittent hook and bucket work, also Strayer-Electric Hook-on and Draglines in sizes and weights for the job and crane. • Erie AggreMeters portable and permanent types for storing, measuring and dispensing of bulk material • Erie Portable Concrete plants that move to the job to make up to 40 yards of specification concrete close to the concrete forms, and Erie Overhead Cranes, custom-built to meet any demand from 5 to 40 tons capacity—welded or riveted plain or roller bearing types. For ready reference, write for condensed catalog.

ERIE STEEL CONSTRUCTION CO.

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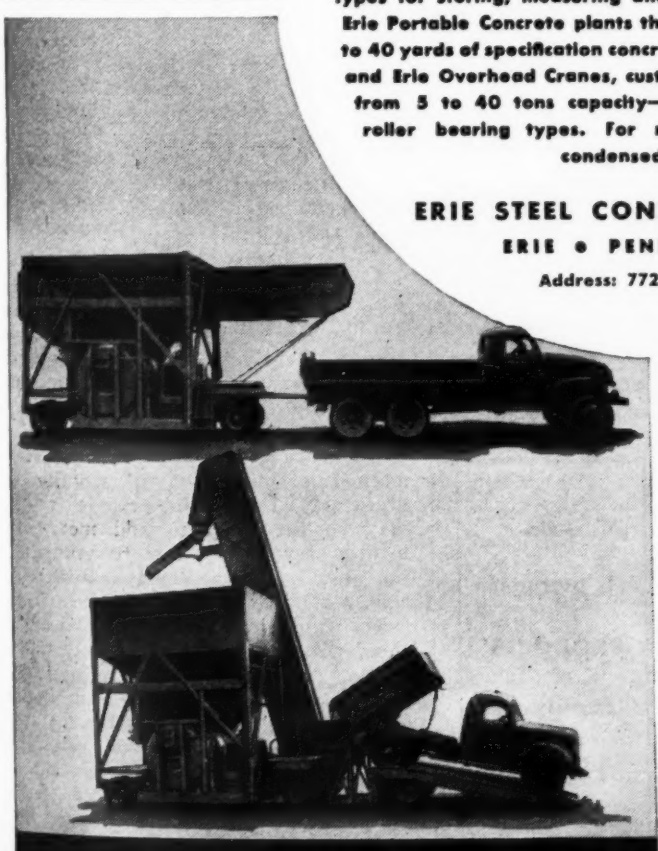

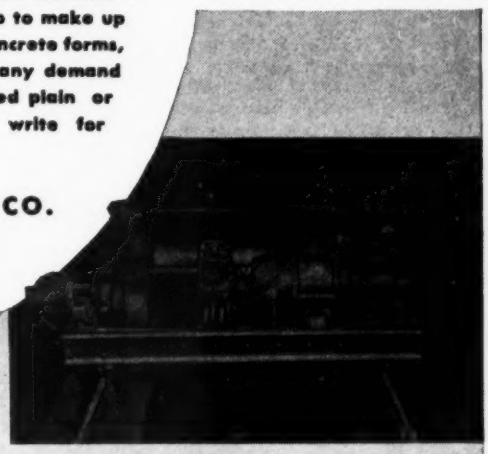

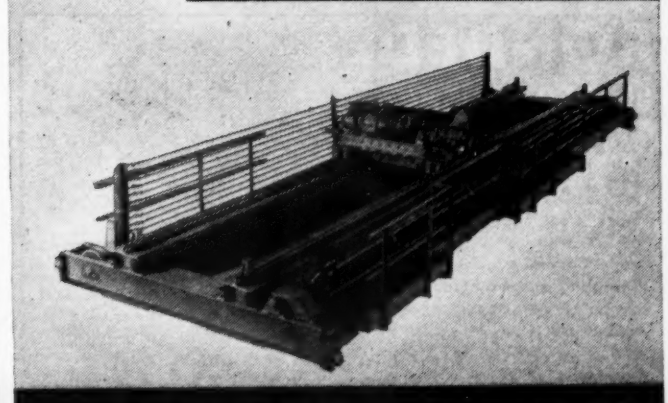

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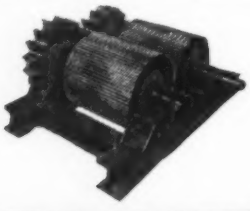

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Concrete Pipe

(Continued from page 153)

ly some producers say that 24 hours and even 12 hours or less is adequate for curing concrete units and in some cases these units are not aged and are placed in service one or more days after they are made. This is risky business for the producer and especially the consumer, and the industry is going to take an awful beating when structural defects develop as they inevitably will. Remember this: the user should be furnished first quality products otherwise he will be dealing with your competitors in the not too distant future.

Batching

(Continued from page 159)

ready mixed plant of that most commonly used, is prepared and one cubic foot of the previously prepared mixed aggregate is placed in the mixing pan. A known amount of paste is added to the aggregate, the whole is mixed thoroughly, and replaced in the cubic foot measure and weighed. This is repeated until there is just sufficient paste to completely fill the voids in the one cubic foot of aggregate. If a vibrator has been used, the mix thus obtained will be a very close approximation to the ideal—a mix of maximum density. For many concrete products plants this will be the optimum mix for practical use. It will have the minimum cement factor and will give minimum volume change in the finished product. It will, however, be too harsh and dry for most construction work. Additional paste must be added until the required job workability, as determined by slump or other tests, is secured. From the weights used throughout the experiment the proportion of each ingredient can be determined, and from that, the weights of each per cubic yard of concrete.

If the above operations are performed carefully, and the samples are representative, surprisingly close results to the mix actually to be used will be secured. As mentioned above, this optimum mix will usually appear and feel "harsh." To properly handle it, vibration or other mechanical methods of placement will usually be necessary. Under job conditions it may be necessary to add more cement/water paste, or more sand and the finer coarse aggregate. However, this trial mix gives a sound basis from which to start, and deviations should be kept to the absolute minimum. Frequent check on the grading of the various aggregate bins will, of course, be necessary. Any decided variation from the original analysis will be reflected in the mix. Once the basic optimum mix is determined, compensation for slight variations in the grading can usually be made, either by computations or inspection of the mixed concrete. If there is any radical change, or if new aggregates

are introduced, the basic mix determination should be repeated. In operating any concrete proportioning plant, ready mixed, construction job or concrete products, the basic law should always be kept in mind: "Using smaller aggregate than could have been used wastes cement."

Optimum Aggregate Proportions for Job Conditions

Another method of determining the optimum proportions of all ingredients in a concrete mix, which may be of more direct value to the ready mixed and construction industries since they require more fluid mixes than the concrete products industry, is by "building up" the actual mix for the required degree of workability. This method, when used with experience and judgment, gives excellent results. It may be considered complementary to the more exact method of determining the mix for maximum density described above. This second method is based on the fundamental proposition that the most economical mix is the one which has the maximum amount of each successively larger size of aggregate within the limits of required workability. Following is an outline of the necessary steps.

A known weight of cement/water paste of the ratio required is prepared. Also known weights of the various aggregates available, room dry, are on hand. Into a large mixing pan a small amount of the paste, (which must be kept agitated during the experiment) is poured and the smallest size of aggregate, in this case No. 50, is mixed with it until approximately the degree of workability required has been reached. Additional paste and regular sand are then added to the No. 50 until the same workability has been reached. The smallest size of coarse aggregate is next added, with additional paste, until the mix again reaches required workability. The process is continued until the maximum size of aggregate available or to be used has been added. Since the weight of each ingredient was known at the start, the amount of each used can be determined and hence the proportions of each for the final mix. If care is used to "load" the mixture with the maximum amount of each successively larger size of aggregate, a very close approach to maximum density for the degree of workability will be secured.

In the operation of a Ready Mixed plant one of the requirements is that the concrete as delivered shall have the degree of workability, the "feel," that the purchaser wants. In many cases this requires the addition of more fines, especially sand, than either economy or quality of finished product would indicate.

EDITOR'S NOTE: The next article of this series will discuss the very simple mathematics used in designing concrete mixtures whereby the ingredient weights to be used to meet specifications are determined on the job or at the plant in from five to ten minutes.

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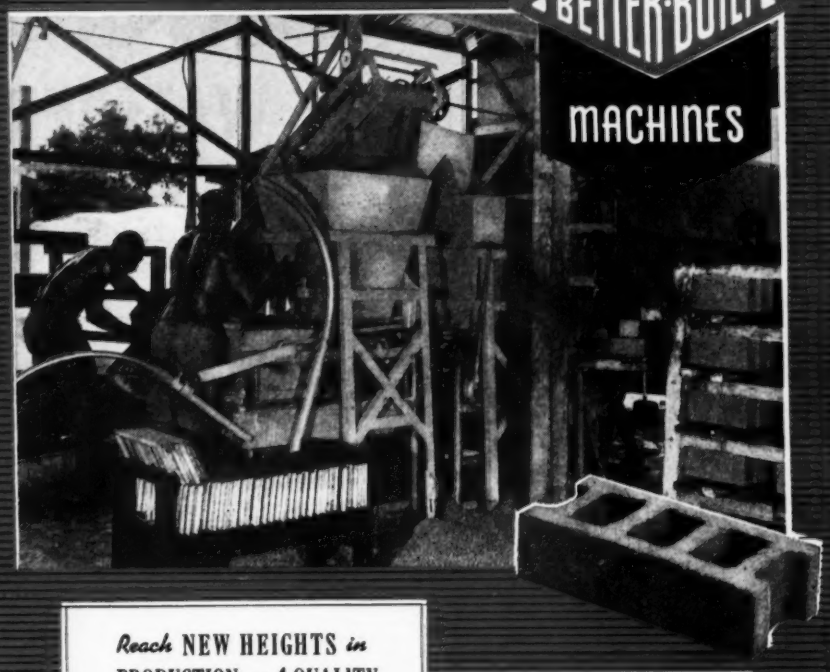

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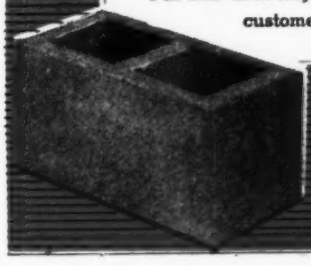

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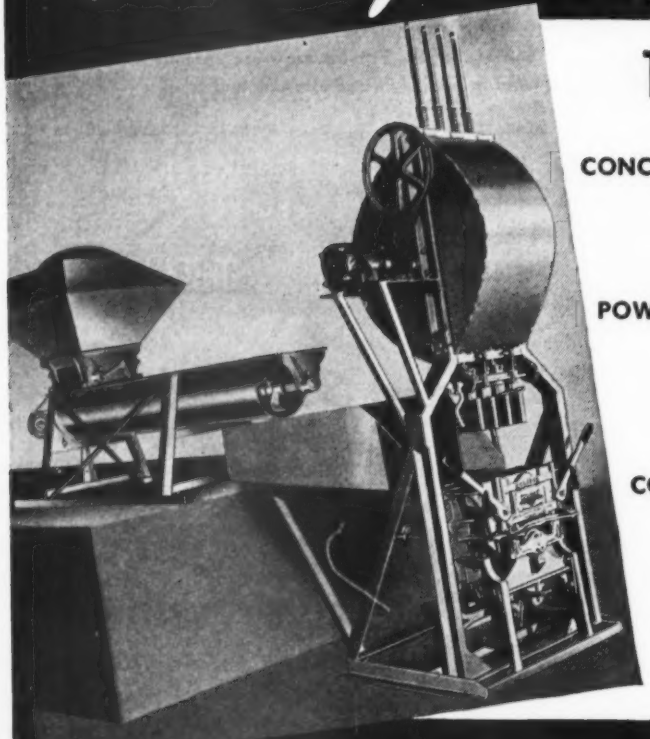

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